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TO ADVERTISERS
CHANGES for advertisements should be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Monday noon to ensure publication in that week's issue.

News comes from California of the completion of a transmission line bringing power from waterfalls in the eastern portion of the state into Oakland and San Francisco, a distance of two hundred and twenty-two miles. This is the longest power transmission in the world and one of the most important. It is believed by those who are most familiar with the situation that electrical power transmission systems will have an immense influence in determining the future of the Pacific coast states—an influence of the most beneficial character. The importance of this feat of engineering is almost overshadowed by the certainty of vast good which must result from it.

THE TELEPHONE AS AN INDUSTRIAL FACTOR.

Invention is full of romance. No man examining the first telephone could possibly have foreseen either the extent of the industry which has grown up as the result of the invention of this apparatus, or even dimly have conceived the industrial importance of the new means of communication. The telephone is now but twenty-five years old and in its short lifetime it has made a new industry of gigantic proportions and has been a benefit to the entire community of such magnitude that it is not possible even now to comprehend fully the debt that we owe to the instrument and its inventors.

When announcement was made of the invention of an electrical machine that would permit speech to be carried on at great distances over a wire, it was received at first with absolute incredulity. A little later the attitude of the public mind toward the telephone was that it was an exceedingly interesting thing but of limited usefulness. No one can truly judge to-day how useful it has been or how much it has done, because it is hard to conceive of the condition of industry, society and commerce had the telephone not been invented and put in use when it was.

Certain concrete facts, however, can be established in connection with it which show that as an industrial factor the telephone has been of almost supreme importance. In the first place, the industry of telephone operation and manufacture has enlisted investment of enormous sums of capital upon which interest is earned and paid, and has given employment to hundreds of thousands of people in a remunerative and important industry. It has stimulated the manufacture of a large number of materials, such as wire, insulators, etc., and in this way has indirectly given employment to additional large sums of capital and additional thousands of operatives. More than these, however, the use of the telephone by the general public has worked such marvelous transformations in methods of business as to inaugurate practically a new era in the conduct of ordinary affairs.

The only other thing with which the telephone can reasonably be compared is the inauguration of cheap postal rates, making communication between the citizens of different parts of the country easy and inexpensive. The stimulation of internal and external commerce which was due to this innovation will probably never be realized to its fullest extent, since we have no conception of what conditions would be at present without these facilities. It is so with the telephone, but one or two points are self-evident. One is that a vast amount of the lifetime of the human race has been saved by the instantaneous interchange of intelligence possible through the agency of the telephone wire. If it were possible to imagine the business of a great city to-day to be deprived of telephone facilities it is at once evident that an enormous number of messengers would be required, and that all sorts of business would be shackled and circumscribed by the difficulty of communication. It is impossible to compute the general benefit that has resulted from the instantaneous and easy exchange of intelligence that the telephone has made possible.

While the value of telephones in purely local affairs is enormous, the importance of the long-distance telephone is almost equally great. To take a simple case, many business transactions between New York and Philadelphia, for example, which formerly required personal visits consuming the whole of one man's time for at least a day and costing a considerable sum for railway fare and expenses, may now be concluded almost instantaneously, without loss of time and at very reasonable rates, over the telephone. It is an encouraging and interesting fact that the

variety of business thus transacted is increasing and that the volume of long-distance traffic is augmenting at a great rate every year. The longer the distance, other things being equal, the more valuable is the opportunity afforded by the telephone for immediate correspondence.

Taking together all of the factors, it is perhaps truthful to-day that the telephone has been one of the most important single additions to the general equipment of the industrial world that has ever been made. On other pages of this issue will be found a description of the present status of the telephone industry in the United States. The figures there given are truly astonishing. More than two million telephone sets are in use, representing a total investment comparable with any of the largest industries. And perhaps the most interesting phase of the present telephone situation is that the industry is evidently only at the beginning of an extended growth. What has been done in twenty-five years is sufficiently astonishing; what will be done in the next twenty-five years staggers the imagination.

THE INSTITUTE.

It has been proposed, under provisions of the new constitution of the American Institute of Electrical Engineers, to establish in the various states what may perhaps be called auxiliary branches of the Institute, and thus afford the great advantages of membership in that important body to a large number of engineers who are not at present identified with it. Any movement in this direction should receive the most cordial and hearty cooperation on the part of all of the members and friends of this important society. The Institute is only at the beginning of its usefulness. What it has already done to benefit American electrical engineering is only a small indication of its possibilities for good. It is unquestionably destined to become one of the most important engineering associations in the world, and more and more is taking on a quality of official authority which makes membership in it of great value. Any proposal to increase its membership, while at the same time carefully restricting membership to those fully worthy of it, is one that should be strongly encouraged.

MANUFACTURERS AND THE TRANSPACIFIC CABLE.

It has frequently been pointed out in these columns that there is almost no greater necessity for the general advance of American commerce, and especially for its extension into the eastern markets from the foothold lately obtained by our fleets and armies in the Philippine Islands than a cable across the Pacific Ocean. Indeed, the question does not admit of argument, and the crying demand for such a cable will ensure its completion at the very earliest practicable moment. While the installation of telegraph facilities of this character will be of immense advantage and be highly appreciated, still it is to be regretted that the American cable, touching only at points under the control of the United States Government, will probably be built by foreign concerns and laid by them.

The history of submarine cables, though brief, is exceedingly interesting. At the time the first transatlantic cables were laid the only manufacturers having experience with such work were English. The first successful, working submarine cables were those laid by British concerns across the English Channel, connecting the British Islands with the Continental telegraph system. These were succeeded by cables across the North Sea giving more direct communication with German points, and, later, by cables laid in the Mediterranean Sea and undertaken as a strategic necessity by the British War Office and Admiralty. The transatlantic cable was naturally manufactured and laid under the supervision of the firms which had already acquired valuable experience in these directions. From that day to this the business of making long, deep-sea cables has mostly remained with the English concerns which were pioneers in the work, although of late there has been some competition from French and German manufacturers.

On this side of the Atlantic there are several concerns amply equipped both with machinery and experience to construct a transpacific cable. One cable differs from another practically only in magnitude and methods of construction, and a concern that can satisfactorily construct and lay a cable a hundred miles long is entirely competent to undertake the construction and placing of one eight thousand miles long, provided certain extraneous conditions which enter the problem can be satisfactorily met. Chief among these is the task of securing proper cable-laying steamships. There are not at present any cable-ships flying the American flag of capacity sufficient to undertake the laying of even the shortest length of the contemplated cable across the Pacific. It is chiefly to this lack that we must lay the blame for the contract for a transpacific cable going to foreign concerns.

At the outbreak of the Spanish War the United States Government secured possession of a large number of steamships for use as transports for troops and animals, and among them acquired a number of very fine vessels of ten thousand tons burden and upward. The military necessity for the maintenance of these transports has largely disappeared with the subsidence of the insurrection in the Philippine Islands, and the government now finds on its hands a number of superb vessels of large size which could be altered into cable-ships sufficient and satisfactory for the purpose at comparatively trifling expense. Were two such ships to be provided it is a foregone conclusion that a number of American manufacturers would at once find themselves in a position to manufacture the cable and put it aboard the ships.

This would mean the construction of water-side cable-making plants situated at such points that the ships could lie at wharves adjacent to the works and the cable be coiled into their tanks as it was manufactured. It is likely that such plants would be built on the Pacific coast to obviate the necessity of steaming around the American continent with the cable on board should it be built on the Atlantic seaboard. It seems almost a patriotic duty that the Congress just assembled should equip such ships. The expense is reckoned at about half a million dollars, which sum is totally insignificant in comparison with the good results that would come from the existence of these vessels, and it is to be hoped that some strong movement will be undertaken by American cable makers to present this matter to Congress in its true light, and to urge that some of the large transports may be altered over and fitted as cable-ships, thus permitting American cable makers a chance to construct the new cable.

THE FOURTH AVENUE TUNNEL.

Information has been made public that the management of the New York Central Railroad Company has undertaken to study very fully the possibilities of electric traction for application to the terminal at the Grand Central Station in New York city, and that Mr. Bion J. Arnold has been appointed electrical engineer for the company to carry on the work. Already experiments have been made at Schenectady with heavy trains drawn by steam and electric locomotives, a dynamometer car being used to record draw-bar pull, acceleration and other data necessary to the solution of the problem.

It seems a foregone conclusion that the facts elicited by this series of studies will lead to the adoption of electric motive power for the terminal section of the roads centering at this important railway station, and it seems possible even to foresee to some degree the conclusions that must be reached from the engineering study of the problem. The terminal presents one of the most difficult situations which has yet been presented to electrical engineers. The station is of the dead-end variety, containing a number of parallel tracks and situated at one end of a switchyard of great complexity, from which four tracks in tunnels lead away to the point where the several railroads entering the station branch off. The space for the switchyard is restricted by a number of conditions and is so small compared with the volume of traffic that is necessarily handled in it as to require the most careful planning in handling the business and the most elaborate precautions. It seems reasonably certain that it will not be possible to use here a system requiring the installation of two sets of feeding conductors of different polarities. The complexity of the switchyard seems to indicate, if not absolutely to require, the installation of a system using a single polarity for the supply system and a track return. This being the case the choice is restricted to the direct-current system, or the less evident but nevertheless possible single-phase system.

Concerning the former it may truthfully be said that there are no problems of very great difficulty to solve. All that is necessary to install a perfectly satisfactory system using direct current is to use the experience that has been accumulated in the direction of heavy traction and design locomotives which will certainly be successful from the start. The direct-current system also possesses a very great advantage in that it will be possible to utilize well-known methods and standard apparatus for the operation of suburban trains, and that upon the same network of conductors high power locomotives running at high speed can handle express trains and through trains, while the local business may be made to approximate street car conditions by the use of motor equipments on all passenger cars and probably by the use of the multiple-unit system in some of its forms.

Concerning the single-phase system it may be said that while little has been done to demonstrate the practicability of such a method of railway traction, yet there are no inherent impossibilities in the use of alternating current of this character for operating railways, while it possesses certain well marked and exceedingly important advantages. If the direct-current system is used the extent of the tracks and conductors involved will almost certainly necessitate the establishment of substations for feeding, even if the highest commercially satisfactory voltage is used. It is doubtful if good practice would dictate the use of more than eight hundred volts on the working conductor, on account of the commutator difficulties which higher electrical pressures would almost certainly introduce. In the light of recent experience it is evident that the conducting system, whether it be placed close to the rails or suspended overhead, will be made very solid and substantial, and it does not seem likely that any difficulties will be encountered in its operation, even in the somewhat restricted space in the tunnels.

The fact that this investigation has been undertaken and that all indications point to the adoption of an electric traction system at this important terminal, is one that should be welcomed as an omen of good import by the whole electrical profession. It is unnecessary to rehearse here the agitation against the smoky tunnel that has probably influenced the company to undertake this study. It is sufficient to say that all indications point to the successful inauguration of the new system and to an increase in public satisfaction which will unquestionably amply repay any expense that may be undergone in establishing the new system.

GOOD LINE CONSTRUCTION.

New York was visited lately by something closely resembling a hurricane which did a very considerable damage to shipping interests in the vicinity, unroofed buildings, blew down trees, interfered with ferry service on the rivers and did practically all sorts of damage except interfering with the telegraph and telephone lines connecting with the city. It is safe to say that ten years ago such a storm would almost have cut New York off from communication with outside points. On this occasion a few circuits were lost for only a few hours and communication practically was not interfered with to any noticeable degree. The fact speaks volumes for the increased excellence of construction of overhead and underground lines adopted by the telephone and telegraph companies, and these should not be forgotten when their services to the public are considered. At the same time no one who remembers the great storm in the spring of 1888, which so destroyed lines of communication that New York and Boston were cut off absolutely from one another by telegraph except through the transatlantic cables via Liverpool, and only one or two telephone circuits remained working between these important centres, will see the necessity that exists here for the construction of a few main trunk lines underground between our largest seacoast cities. In England the postal-telegraph service of the government has laid an underground line of telegraph wires from London to Birmingham, thus rendering it practically impossible for any storm, no matter how severe, to affect the working of the main line of communication in the British Islands. Certainly Boston, New York, Philadelphia, Baltimore, Washington, Pittsburgh and Chicago should be connected by some such system, for even a day's interruption of communication between these points would prove an almost incalculable loss and a source of immense inconvenience to the business interests of the country.

Science Brevities

Structure and Capacity of Dielectrics—An article upon this subject by M. von Hoór has been published in the *Elektrotechnische Zeitschrift,* and digested in a British contemporary. He has made some 8,000 measurements of the inductivity of paraffin, gutta-percha, glass, mica and impregnated fibre dielectrics. As regards the latter, they were found to be subject to a great variety of disturbing influences, such as air bubbles, faulty impregnation owing to viscosity, low temperature or impurity of the impregnating substance, and traces of acids or chlorine. Perfectly pure linen, jute, or manilla fibre substances, impregnated with liquid or well-melted pure paraffins or resins, showed a very uniform behavior, and their specific resistance was found to be very high. In freshly prepared paraffin condensers there is a slow settlement, which lasts several weeks, and is the slower the higher the melting point of the paraffin, or the lower the temperature at which the condenser is maintained. Condensers made of alternate films of glass and silver fused together show a rather high conductivity, but also a great capacity. Condensers made of layers of mica stuck together, like the so-called micanite and megohmite, show an almost complete independence of the capacity from the voltage to which they are exposed. It may be generally stated that great viscosity is shown by dielectrics composed of various successive layers. The thickness of the layers is also of great moment. As the thickness increases the hysteresis per cycle and per cubic centimetre also increases.

Electric Waves—A pretty full discussion of the theory of the propagation of electric waves along wires is contributed to the *Annalen der Physik* by M. Abraham, whose article has been digested in a London contemporary. He distinguishes two cases, in the first of which the return current is a pure conduction current, and in the second of which displacement currents also come into action. Ordinary telegraphy and telephony belong to the first category, and space telegraphy to the second. In oscillations of the Hertzian order it depends upon the distance between parallel conductors whether dielectric return currents come into play. The author discusses the relation between the conditions of propagation and the electromagnetic energy of the waves. He proves, among other theorems, that in stationary electromagnetic oscillations in a field bordered partly by perfect reflecting surfaces, while through the remainder plane homogeneous waves import and export energy, the mean magnetic energy equals the mean electrical energy. In the case of wire waves, the effective and apparent internal inductances are identical, and when the return circuit is metallic, and, therefore, the values of the apparent capacity and apparent external inductance are real, these values are identical with the values of the effective capacity and the effective external inductance derived from the field energy.

Some Chemical Effects Produced by Radium Radiation—M. Henri Becquerel has recently done some work upon this subject. A paper in which his work is described has been reviewed in *Nature.* It is pointed out that the radium radiations consist of a part capable of deviation in the magnetic field, identical with the cathode rays, and a part non-deviable, a fraction of which is absorbable, and the remainder extremely penetrating. Some kind of spectrum analysis is, therefore, necessary before studying the chemical action of these rays. Fresh observations are brought forward showing the action of the rays upon glass, the transformation of yellow into red phosphorous, the reduction of mercury perchloride in the presence of oxalic acid and the effect upon seeds. In the latter case it was found that prolonged exposure to the radium radiations had the effect of destroying the power of germinating in the seed.

Testing Carbon Anodes—The value of carbon terminals depends not only on their conductivity but also on their permanence or resistance to disintegration. Although carbon itself is practically unattacked by chlorine or, except very slowly, by other oxidizing agents in solution, hydrocarbons and ash constituents in some commercial samples are very readily affected. Herren Foerster and Sprösser, in *Zeits. aug. Chem.,* investigate this subject and propose a method for valuing commercial carbons. Their work has been abstracted in *Lightning.* A rectangular sample is cut from each, and made the anode in a solution of sodium chloride with a little sodium chromate between two platinum cathodes in a vessel provided with a rubber stopper and delivery tube. The addition of sodium chromate is derived from an idea of Herr E. Müller's, who found that the effect of adding small quantities of chromate to solutions undergoing electrolysis was to form a "film-diaphragm" of hydrated chromic oxide on the cathode, acting like the film of lime which is deposited in the electrolysis of calcium chloride solutions. He considered that electrolysis in the presence of chromate formed an ideal diaphragm process. Herren Foerster and Sprösser use in conjunction with this cell an ammeter, and both an oxyhydrogen and a copper voltameter. The ratio of the oxygen and hydrogen liberated in the cell to that registered by the voltameter gave the current yield in hypochlorite and chlorate, if no action on the carbon anode had occurred. The gases from the cell were analyzed and compared with the weight of copper deposited in the copper voltameter, showing the actual current yield of active oxygen, and the difference between the two results gave the amount of current consumed in the disintegration of the carbon anode. The method of testing in sulphuric solution may, with care, be used as confirmatory. Carbons from a number of makers were examined and found to vary largely in value. The tables give the mean of a large number of determinations, and include the volume of the pores, the percentage of ash, fraction of the current used in formation of active oxygen and in destruction of anodes, loss of weight by oxidation and by disintegration, production (with diaphragm) of CO_2 and O, and loss of weight, with diaphragm, for 100 ampere-hours at eighteen degrees centigrade. The chief destructive chemical action is one of oxidation, forming soluble humous substances which deposit as a dark film on the cathode, leading to the impression that carbon could be electrolytically deposited like metals. With carbon anodes in twenty per cent sulphuric acid, it is stated that nine-tenths of the current is employed for the combustion of the carbon in all cases, even with graphite. Carbons of extra hardness, while not losing so much mechanically, are said to be chemically "not very satisfactory." With caustic soda the action is not so great; Acheson graphite was hardly attacked at sixty degrees centigrade, while some of the amorphous kinds were more affected, the difference was not so great as in acid solutions. Porosity of the carbons favors attack, but the disposition of the pores has also great influence, as if these form channels leading outwardly, the electrolyte more easily penetrates and the destruction is greater. For alkaline chloride solutions the anodes require to be of large dimensions and as free as possible from ash and from pores. For aluminum and carbide these requirements are not so necessary. Graphitized carbons are proposed to be used instead of platinum-iridium in chlorate manufacture.

The Electric Tramway of St. Moritz, Switzerland.

An Interesting Installation in the Capital of the Engadine.

By Enrico Bignami.

THE ELECTRIC tramway installation at St. Moritz, in the Engadine, is perhaps the smallest installation of electric traction in Europe, but by no means the least interesting.

Among all the Alpine regions the most interesting is that of the Grisons canton. While the number of its inhabitants is small, it is perhaps the largest of the Swiss cantons and the richest in natural beauty. It stretches from the plains to the high regions, with beautiful villages alternating with richly cultivated fields, verdant pastures and charming lakes surrounded by forests of pines and beeches. In it deep valleys and fertile prairies at altitudes of 7,000 feet above sea level lie between imposing mountains, from the feet of which rush innumerable swift and snow-fed mountain torrents. The town of Coira is surrounded by high summits and charming valleys in which are situated some of the most magnificent hotels in Europe, and thermal baths and medicinal bathing establishments which have long been celebrated everywhere.

Among all of the valleys of Grisons that of the Upper Engadine is the most important and certainly the most beautiful. It would not be far from the truth to say that in its size, the perfection of its climate, its fertility and the magnificent panoramas of mountain and valley spread on every hand, as well as on account of the many improvements which have been erected in it, it is perhaps the most splendid resort region in the whole of Europe. The mountains of this neighborhood are also rich in mineral springs, and, not to mention others, it may be said that those at Tarasp and at St. Moritz enjoy the highest vogue for cures of numerous maladies.

It is natural that these waters and the natural beauties of the situation should attract a large number of visitors to the Engadine, and at St. Moritz especially, on account of its situation and its high altitude (6,000 feet above sea level), there is for three months of the year a highly cosmopolitan concourse. Many roads lead into St. Moritz and to the neighboring town of Samaden, which is the centre of the Upper Engadine and the point of departure of the federal diligences or omnibuses, which form one of the best known means of transit in Switzerland.

The whole of the Upper Engadine region has a character peculiar to itself; there are other enchanting valleys and other pleasant spots in Switzerland, but one scarcely expects to find in the region of the eternal snow and of the glacier a flourishing city adorned with all the advantages of civilization. Ordinarily, at nearly 7,000 feet above sea level, one expects to find only the shepherd with his flock, an occasional small hamlet or a profound solitude. The situation of St. Moritz is such that power for electric lighting and traction can be easily procured by utilizing the water powers of the Inn and the Julier. For the great hotels of St. Moritz there were constructed in 1886 and 1891 two central lighting stations, and later the system of electric traction has been added, taking its current from one of these plants.

On account of the steep grades in the neighborhood, which make animal trac-

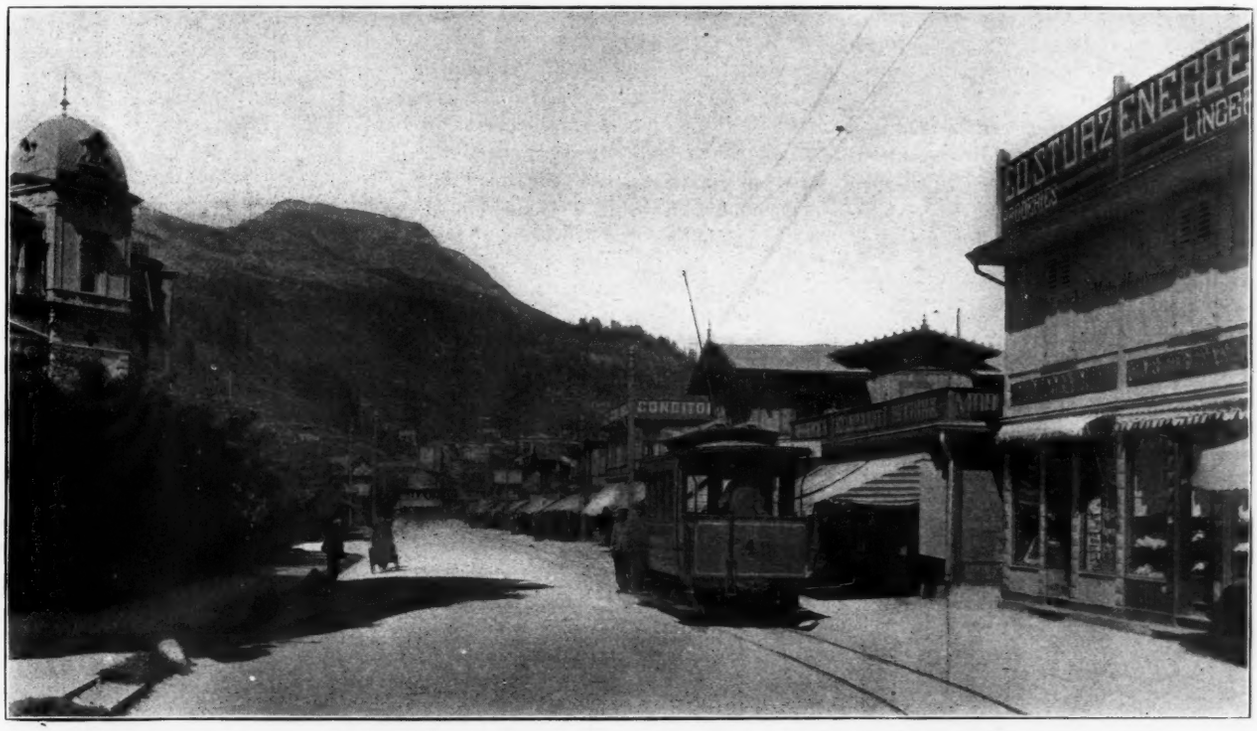


FIG. 1.—TRAMWAY LINE IN THE PARACELSUSSTRASSE, SAINT' MORITZ.

tion difficult, and the abundance of water power, electric traction is, of course, the natural solution of the tramway problem. The line illustrated has a single track connecting the town of St. Moritz with the thermal springs in the neighborhood and runs from the centre of the town along the cantonal road, which has been widened ten feet on this account, to the Paracelsusplatz. Along the line are situated a number of the great hotels of the region. In building the line it was necessary to remove the iron bridge carrying the road over the river Inn upstream and to construct a new bridge for the trolley cars. Widening the road was the cause of no small expense and trouble, for in several places this required the construction of sustaining walls and facings and very costly excavations. The rails are of the Phœnix type, laid on wooden crossties.

In one of the lighting central stations is a direct-current dynamo, direct-coupled to a 350-horse-power turbine, which furnishes motive power for the line. The rolling stock is composed of three cars,

FIG. 2.—CURVE NEAR THE ENGADINER HOF, SAINT MORITZ.

each having twelve seats and twelve standing places, and each equipped with two twenty-horse-power motors.

In one of the illustrations is shown the terminus of the line at the springs establishment, and there may be seen the two methods of traction representing the old and the new in Switzerland. Passengers going on further debark from the sumptuously furnished tram cars and take the donkeys seen patiently standing in the foreground. A schedule of five minutes' headway is maintained morning and evening on the trolley line for the benefit of travelers to and from the springs.

The cars and other equipment were manufactured by the Elektrizitäts Aktiengesellschaft, of Nürnberg, Germany. The type of cars and trolley construction is excellently shown in the accompanying illustrations, which also give a good idea of St. Moritz and its surroundings.

Enrico Bignami.

Of late there have appeared in the ELECTRICAL REVIEW several entertaining articles written by Signor Enrico Bignami, of Milan, whose portrait and a short account of whose interesting career appear below.

As a young man Signor Bignami was forced by circumstances to earn his living in manual pursuits and found himself finally in charge of a construction train for a railway in Italy. Taking up at this time university studies he had scarcely entered the course of instruction when the war for Italian independence broke out and he enlisted at once as one of the enthusiastic followers of Garibaldi. He took part in the campaigns for the conquest of Rome, and at the termination of the struggle determined to devote his life to the revolutionary propaganda and started a socialist republican newspaper in a small provincial town in Italy. The subject of a variety of persecutions on account of his advanced position in these matters, he was compelled finally to flee the country to escape imprisonment and necessarily set to work to discover a means of livelihood.

In 1881, being at Paris on business connected with railway concessions, he became acquainted with the capitalists who were then interested in the storage battery of Faure. It was here that he received the suggestion that he should devote himself to the study of electricity. Returning to Milan he began the study at the time when the electrical industry in Italy was in a very rudimentary condition, and shortly after began the publication of the weekly electrical journal, *L'Elettricita*. This journal is to-day the recognized and authoritative electrotechnical publication of Italy. Signor Bignami has not confined himself to his editorial duties in connection with this journal but has been active as an inventor, having patented a number of apparatus useful in telephony, primary and secondary batteries, etc. He has also published a series of books, several of which have been exceedingly successful, and has at the same time kept up the revolutionary and socialist propaganda to which

ENRICO BIGNAMI.

he early devoted himself. At present living in the beautiful Swiss town of Lugano, near the Italian frontier, he is probably the most active figure in electrical journalism and in the agitation of electrical development in Italy. His sources of information are so large and his knowledge of the situation of the electrical industries in Italy, Switzerland and the neighboring states so full and complete as to lend additional interest and value to his communications, which are marked also by an easy and pleasant literary style. Signor Bignami writes equally well in the French and Italian languages and is regarded as the most authoritative writer on electrical subjects in his country.

British Tramway Changes Hands.

The following tramway news has been sent by United States Consul McFarland: The horse tramway system of Northampton, which was established by a private company in 1881, was this week taken over under purchase by the Northampton corporation, at a transfer price of $182,493.75. The working hours of employés have been reduced and other reforms instituted; but the purpose of the city in acquiring the plant is to convert it into an electric system, and enlarge it to suit the needs of the locality. This conversion of private into public tramway enterprises is proceeding generally throughout England, and in every instance so far has been perliminary to the institution of modern electric service.

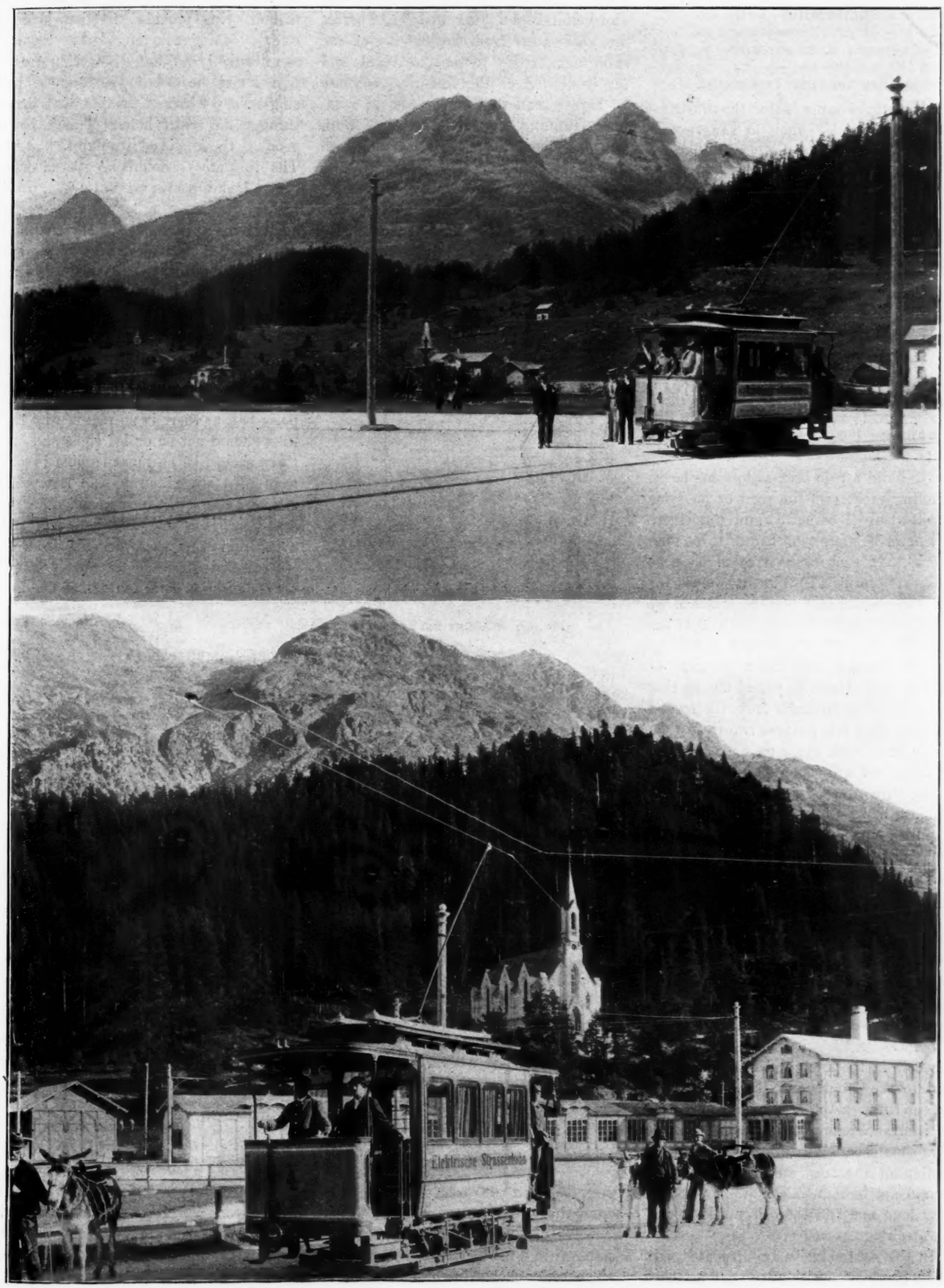


Fig. 3.—The Kurpark in St. Moritz.

Fig. 4.—The End of the St. Moritz Tramway—The Old and the New Methods of Passenger Transportation.

CONSTRUCTION OF SMALL TELEPHONE EXCHANGES—XVII.

BY A. E. DOBBS.

SOME TRICKS OF THE TRADE.

It sometimes happens that the construction man is called upon to run two or three lines in places where it would hardly

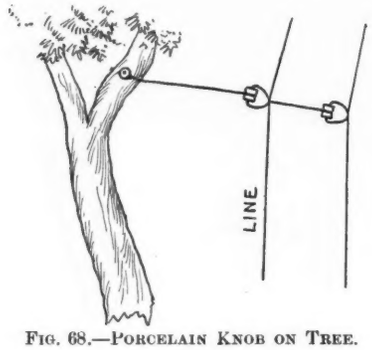


FIG. 68.—PORCELAIN KNOB ON TREE.

pay to build a pole line, as to some house standing back from the road or on some street where it seems certain that there will never be more than two or three telephones. In such cases it often happens that a tree forms a convenient support for the wire, which can best be attached by nailing a porcelain knob to the side of the tree, as in Fig. 68, or a bracket, as in Fig. 69. In order to keep the wires clear of the tree they should be placed on one that will pull off at an angle from the rest of the line. For this purpose two trees diagonally from each other on opposite sides of the street are sometimes selected and a long wire attached as a hanger, ten feet or more in length, which, when the wire is pulled up, allows it to swing free of limbs or foliage. A line can sometimes be zigzagged in this manner for half a mile or more.

In addition to the knob on the tree (Fig. 68) there is also another knob or circuit-breaker to each wire to which the wire loops are attached, thus making two knobs between the line wire and the tree trunk.

Sometimes the wire is passed through the hole in the knob and sometimes it is tied to the groove and the hanger wire passed through the hole and looped back on itself. Whatever method is used, the wire should be left free to swing with the motion of the tree, and for this reason should not be tied unless the hanger is a very long one and there is no danger of its breaking.

In Fig. 69 the knobs are dispensed with and a single wire with a loop end attached to a bracket on the side of the tree. This is better than the use of porcelain knobs, for the insulation of the wire is in this way maintained in wet weather, whereas the water runs from the outside of the knob and directly to the tree trunk and the insulation of the line thus becomes no higher than that of the film of rain-water running down the outside. With the glass insulator the place underneath the skirt is nearly always dry and its superiority as an insulator is due solely to this fact.

Fig. 70 shows a method of suspending wires across the street where there are so many trees that a pole line is out of the

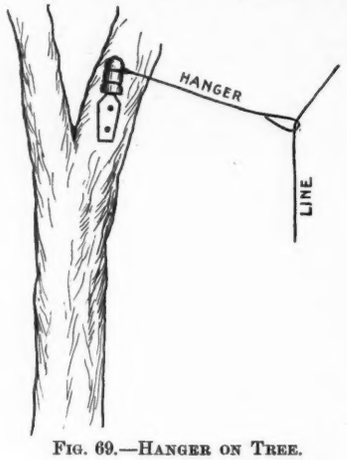


FIG. 69.—HANGER ON TREE.

question and where, at the same time, there are not wires enough to justify a cable. The writer has seen as many as twenty-five wires suspended over a street in this manner.

The insulators in this case are tied between two No. 9 wires that are pulled across the street from tree to tree, two tie wires passing around the top groove, as shown in Fig. 71.

The hooks shown in the bottom of the insulators may be ordinary screw-eyes cemented into the glass. The wires may be left suspended loosely in the hooks without tying, provided the screw-hooks or screw-eyes are so arranged that the wire can not easily fall out. Sometimes porcelain knobs have been suspended on a single No. 6 wire and the line wires drawn through the centre holes. This is not as good as the petticoat insulator, however. The insulators should be spaced about twelve inches apart; access to them can be had by means of a long ladder resting against the span wires. They should be so suspended that the centre of the span will not be less than eighteen feet above the ground.

One of the objections to be urged against this form of suspension lies in the fact that if the lines should become crossed the trouble man can only reach them by means of a long ladder or a pike-pole; but, as there is no reason why these lines should not be pulled tight and even, there should be no more trouble in them than in a straightaway pole line. This sort of a line is not recommended for general use, but is suggested as a temporary expedient where there are few lines and where shade trees or extremely narrow streets make a pole line out of the question.

SIDE-ARMS.

There is another method of avoiding trees or tall buildings, shown in Fig. 72, which consists in bolting the arms to the pole at one end instead of at the usual place in the centre. The outer ends of the arms are supported by a flat strap iron

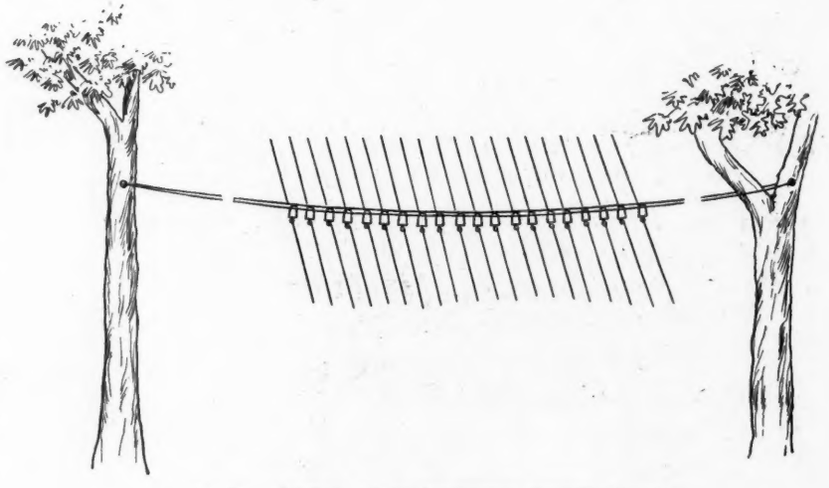


FIG. 70.—LINE OF WIRES SUSPENDED BETWEEN TREES.

brace, which spaces them all equally and which connects at the bottom arm with a side brace made of two-inch pipe—or a two by two-inch angle iron—flattened together and drilled for the proper bolts at the ends. These bolts should not be smaller than one-half inch, while the attach-

ment to the pole should be made by means of two seven-inch lag-screws. The strap iron brace is made three-eighths by one and one-half inches, with holes drilled at the proper intervals to pass a one-half-inch bolt through the arm. Where the pull is

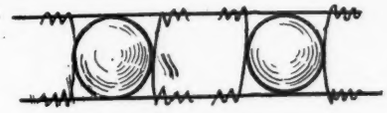


FIG. 71.—TIE WIRES.

heavy, this strap brace is sometimes doubled, there being one each side of the arm.

In getting the length of the lower brace between the points F F′, first measure the distance from the pole face to the hole through the arm F′. Then measure the same distance down the pole to get the spot F, which gives this brace an angle of forty-five degrees, which, all things considered, makes the strongest support.

Example—Suppose that the distance from the pole to the hole F′ is eighty inches. By measuring from the centre of this arm down the pole make a mark at the spot F. Now the distance from the poles F F′ is found by the usual rule (*the square of the hypotenuse is equal to the sum of the squares of the other two sides*), which makes one hundred and thirteen and one-third inches between the holes F F′. By marking out these spots and having the braces made beforehand, the arms will be leveled up when the brace is put on, without sighting.

If necessary, more arms can be added at a future time, the lower arms being suspended by strap braces from the ones above them. The weight that the lower brace will safely stand, however, must always be kept in mind. To prevent the pole from leaning toward the street from this one-sided weight, it should be given a slight rake backward from the centre of the street. In many places the use of some such construction as this is almost compulsory.

BRACKET LINES.

It sometimes happens that a pole line is put up to carry from four to six wires and it hardly seems worth while to put on cross-arms, but generally it is a case of gradual growth. First there are two brackets, then one or two more, and later, perhaps, two or three more are added. Aside from this, however, there may be a good reason for the use of a bracket line in some places, as it generally does not require so much tree trimming. In Fig. 73 is shown a plan of bracketed lines that can be made to look as well as though an arm was put on. In the first place, the diameter of the pole is six inches. The width of two brackets placed opposite each other makes from seven to eight inches more, so that two wires placed opposite each other and tied on the outside of the glass are about thirteen inches apart, which is farther than if placed on a standard arm. From the top of one bracket to the top of the next is also fourteen inches, so that we have regular arm spacing, which enables us to pull our wires "level" with each other. As said before, such a line can be made to look as well and be as free from trouble as though an arm was put on, but the trouble is that bracket

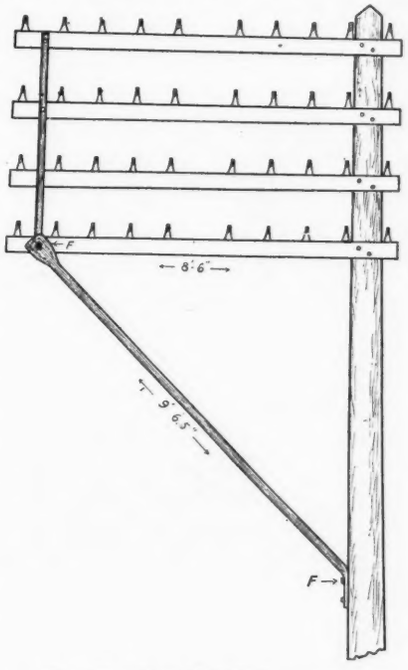


FIG. 72.—SIDE-ARM CONSTRUCTION.

lines are often not properly guyed and braced, wires pulled slack or tight, as the lineman's fancy may dictate, and brackets placed without regard to any other bracket on the pole.

Temporary work is the bane of many telephone exchanges, for many and many a time lines are carelessly put up with the expectation that they will be permanently placed next week, but the next week comes around with its own work and its own troubles, and the work done "temporarily" is never repaired until finally so much of it accumulates that a new gang of men has to be hired to rebuild the entire plant.

If you are going to build a line, even though it be a bracket line, build it *right!* Gain the poles so that you can put on an arm at some future time if need be. Space the brackets at regular distances apart and pull the lines as tight and guy the line as well as though it is intended to last ten years. Then, if you should change from a bracket to a cross-arm line, the wires would all be in place and merely have to be lifted up from one insulator to another.

Sometimes, where two or three lines run together for quite a distance, it becomes necessary to transpose them occasionally in order to ensure quiet service. With cross-arms in use some of the break-arm devices shown in Fig. 61 can be used to good advantage in the absence of regular transposition insulators and pins. Transposition insulators all require especially long pins, if we except the ordinary double-grooved glass which may be used on short lines as a transposition glass.

There are three methods that might be used to break a circuit for the purpose of crossing the wires, which are shown in Figs. 74, 75 and 76, where the regular transposition insulators are not available.

None of these are to be commended, and are merely shown as expedients to be used on cheaply constructed lines. Of the three, Fig. 76 is probably the best.

Electrophone for Deafness.

The electrophone has been invented by Dr. Samuel G. Tracy, of New York. It is an electrical device which combines the principles of the microphone and telephone, and is so constructed as to magnify sound at least five times. The purpose of

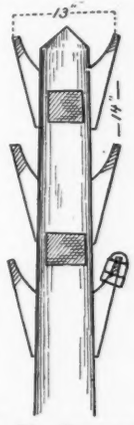
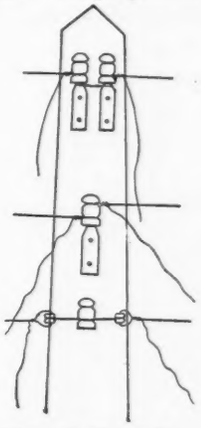


FIG. 73.—BRACKETS.



FIGS. 74, 75 AND 76.

the instrument is to supersede ear trumpets and conversational tubes. The central parts are a sound transmitter, a sound receiver, a specially constructed induction coil and an electric battery. For the battery a dry cell is used, which does not require renewal oftener than about once a month. It is said that the instrument can be used as an aid to hearing in about eighty per cent of chronic catarrhal deafness and in a small percentage of cases of deafness rising from other causes. Some therapeutic value is also possessed by this instrument from the fact that it gives an activity to a dormant auditory apparatus. It is said that it should also prove useful as an aid in the instruction of deaf mutes.

Electric Lighting Policies.

By Henry L. Doherty.

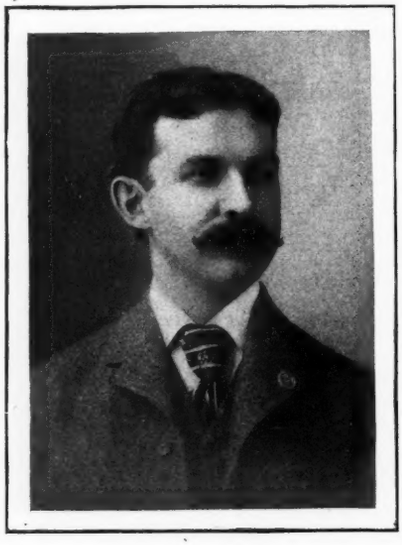
MR. HENRY L. DOHERTY, of Denver, president of the National Electric Light Association, and one of the most successful organizers and operators of electric lighting properties in the United States, contributes the following to the general discussion of the future policy of the electric lighting industry:

To the Editor of the Electrical Review:

For the sake of brevity I will sum your letter up in the form of six questions and attempt to answer them.

Question 1—What new inventions are needed for the development of the central station business?

Answer—(1) We need a good and inexpensive indicating and recording instrument for weighing flue gases to guide and check the work of our firemen. It should not lag more than one minute behind furnace results. (2) We need better protection for long-distance transmission lines from interruption to service and damage from lightning. (3) We need motors, and especially polyphase motors, having a greater range of speed. (4) We need less expensive, less cumbersome and more reliable high-tension switches. Were I working on this problem, I would be inclined to experiment with ordinary knife switches, using compressed air to extinguish the arc. (5) We need automatic pressure regulators to obtain current for lamp and meter testing and other laboratory work of absolute uniform voltage. We could also use such a regulator on generators, circuits or transformers. An alternating-circuit regulator should be easy and inexpensive to construct, while a direct-current regulator would be more expensive but probably no more difficult. (6) We need a reliable and efficient rectifier for charging storage batteries from alternating-current mains, and such a rectifier would be useful in many other ways. (7) We need an automatic compensator to correct variable lag in alternating-current feeders and translation apparatus. (8) We need a storage battery of less cost and higher efficiency and of maintenance and nursing. (9) We want a more durable and reliable meter, one that will do business with less cost for direct currents, or to be general, we want a meter as accurate, cheap and reliable as the badly abused gas meter. (10) As the internal combustion engine gives the greatest promise toward economy in generation, we want an engine of this type with good regulation, less difference in angular velocity, and at a cost more nearly equal to that of the steam engine. (11) We want a better producer-gas generator which will operate on cheap lignite and bituminous coal, which will yield a gas of uniform value and operate at a temperature sufficiently low to permit the use of fuels containing the most fusible ash. As the capacity of an internal combustion engine is approximately proportional to the calorific value of the explosive mixture, a more ambitious wish would be for a gas of



Mr. Henry L. Doherty.

higher calorific value per foot than producer-gas, and yet one which would contain as large a percentage of the original heat value of the coal. Until we can find some cheap means for the production of oxygen I am not sanguine of the production of such a gas, although some very high efficiencies are reported in European practice where the Delwik process is used. These are but a few of the many things we want.

Question 2—What will be done toward disposing of such by-products as hot water and steam?

Answer—I will not attempt to say, but there are some collateral considerations which must not be overlooked. (1) It is frequently more economical to run condensing than to attempt to sell the heat in the exhaust steam, even if no condenser water is available and cooling towers must be used. The evaporation of the same quantity of water as is used to feed the boilers is approximately sufficient for cooling condensation water. (2) It would generally be cheaper to use a mechanical draft and abstract the waste heat from the flue gases by open or closed heaters, transmitting it by hot water, than to heat the water by exhaust steam. (3) The adoption of internal combustion engines would often show greater economy than steam engines even with a good market for exhaust steam.

Question 3—What changes will there be in handling the output of electrical stations?

Answer—I think this largely depends upon the development of storage batteries. If we must continue to use storage batteries requiring an investment of $100 per horse-power, with an efficiency of but fifty to seventy-five per cent, and a maintenance charge of from five to fifteen per cent, the present trend toward alternating currents will continue. For congested districts I see no vast improvement that can be made on the three-wire, direct-current system, and for less congested districts I see no vast improvement which can be made on the three-wire, 110 to 220-volt, single-phase system for lighting, or the four-wire three-phase system for light and power. The natural tendency must be for the use of consolidated generating stations well located for reception of fuel and condensation water and with mechanical equipment for handling fuel and ashes, using large multi-expansion engines or steam turbines. The latter certainly give more promise than reciprocating engines, permitting a fair saving in first cost of prime mover, a large saving in cost of generation, a greater saving in cost of real estate and buildings, less attendance, greater durability and better results from synchronous operation of generators. Another possibility is the use of producer-gas generators and gas engines, or the use of producer-gas generators and turbines adapted to the use of the products of combustion from this gas burned at the entrance to the turbine.

Current will be generated preferably as three-phase current, yielding the minimum loss in transmission and the greater reliability of six-phase rotaries. Transmission will be at higher voltages than now prevail, and as underground methods must become more general we may naturally expect the use of high-tension cables such as are being successfully used at St. Paul

at 25,000 volts pressure. Secondary transmission will be accomplished by substations for rotaries where direct-current is used, distributing on the three-wire network system, and where alternating current is used, by interconnected primaries and subway transformers with primaries connected in delta and secondaries connected in Y, with interconnected four-wire three-phase distribution and lights and motors connected up on the same secondary mains. Rigid specifications being required on performance of motors to prevent disturbance to electromotive force, oil-type water-cooled transformers may be used to dissipate heat generated in transformers. The simplest means of water cooling would probably be a series pipe which would absorb the excess heat of the transformer, passing through the oil-immersed water coils, and would in turn impart this excess heat to the ground in passing on to the next transformer.

Question 4—Methods of extending electric lighting to meet the competition of other illuminants.

Question 5—Methods further to develop business.

Question 6—How may loss be discounted which would result from a marked improvement in the efficiency of lamps.

Answer—These questions may all be met generally by the use of a logical method of charging. The rate question is too long for an intelligent exposé in a single issue of your journal, but if any one wants to know my views on the subject, they can refer to a paper which I read at the 1900 convention of the National Electric Light Association, or at the 1901 convention of the Northwestern Electrical Association. The adoption of this rate scheme in Denver, Col., has, in six months, increased the use of the connected load from sixty-one minutes per day to eighty-eight minutes per day, and we look for a still greater increase.

I think the most potent factor toward increasing our output will be (1) the higher standard of illumination which is constantly being demanded; (2) decorative lighting, such as outlining buildings, and (3) sign lighting.

Our fathers were content with an illumination of probably one-tenth of a candle-foot, we demand an average illumination of, say, three-quarters of a candle-foot and our children will demand an illumination of five candle feet. It is all a matter of education and habit.

Decorative lighting has come to stay. The outline lighting of the Pan-American Exposition is what we may expect to see on the buildings of our more progressive merchants, but we must get away from the twenty cents per kilowatt idea before we can expect them to adopt such lavish illuminating displays. Twenty cents a kilowatt is too low a price if they are only going to use their lights on holiday occasions, and about five times too much if they are going to light up six hours each night and every night in the year.

Sign lighting is a growing thing. Cities can and will some day encourage electric signs by allowing them to trespass over the sidewalk and street, to the exclusion of the lifeless sign which mars rather than beautifies the street's appearance and which adds nothing to the street illumination. The billboard of the future in congested districts will spell out its words in electric lamps.

The question of a high-efficiency lamp is a constant menace to the earning power of every station selling current on a per kilowatt-hour basis. You have certain fixed expenses which are constant, regardless of consumption of current. They are determined by the number of consumers a station has and the demand they occasion. If a fixed charge is made to cover these fixed expenses, the earnings of the plant are not seriously jeopardized by the production of a high-efficiency lamp.

HENRY L. DOHERTY.

Denver, Col., December 4.

Electrochemical and Electrometallurgical Industry—IV.

ARTICLE IV: PROGRESS IN GERMANY.

By John B. C. Kershaw, F. I. C.

INTRODUCTION.

ELECTROCHEMICAL and electrometallurgical industries have been hindered in their growth in Germany by the lack of natural water power capable of economical development for manufacturing purposes. It is a curious fact—one that well illustrates Emerson's law of compensation—that the two countries in Europe occupying the leading positions in manufacturing industry at the moment are both deficient in the supply of power destined to take the place of coal.

England and Germany owe their manufacturing importance largely to their possession of extensive coal fields capable of economical working, and it is chiefly to the active use these two nations have made of this source of power that their wonderful progress during the third and last quarters of the last century has been due. The energy and inventive genius of the German and English peoples would have counted for little had no such source of cheap power been available.

But coal fields, unfortunately for these two countries, are exhaustible, and at some point of time in the century upon which we have just entered, it is possible that both in England and Germany these natural stores of energy will be worked out. By that date the water-power developments in other countries of Europe will no doubt be able to supply a large proportion of the total power required in manufacturing industries; and the old question of what is to become of this quarter of the world when her coal fields are exhausted will be found to have been satisfactorily solved by the combined skill of the electrical and hydraulic engineer.

In the meantime Germany and England are making the best possible use of the power at their command, and great strides have been made in recent years in the more economical generation of mechanical and electric energy from coal. As pointed out in Article II, the use of gas engines of large size, fed either by special producer gas or by the waste gases of blast furnaces, is extending in Germany, and at Differdingen, in Luxemburg, a power plant is already at work supplying 5,400 horse-power from the *waste* gases of blast furnaces.

Such plants, if these large gas engines prove reliable and durable under the conditions of continuous work, are likely to increase in number, and the prospects of a cheap supply of electric energy for manufacturing industries of all kinds in both countries are thereby immensely improved.

In Germany, owing to the better and scientific technical training of the heads of the large industrial establishments, the

progress is likely to be more rapid than in England. Electrometallurgical manufactures, which have been supposed to be only remunerative when carried on with very cheap power drawn from water, will, no doubt, be established in connection with the iron smelting works of western Prussia. The German chemists and metallurgists have carried on valuable pioneer work in nearly every branch of electrochemical and electrometallurgical science, and now that a supply of cheap electrical energy in bulk seems to be available, they will doubtless make efficient use of their opportunities.

Whether English or German scientists will ever solve the problem of extracting energy from the ether, and thereby stave off the threatened danger that approaches with the exhaustion of the coal fields, remains for the future to disclose. Should this task prove too great for man, the twentieth century will most likely witness a striking change in the industrial position of European nations, and the supremacy of England and Germany will probably pass to those countries which at present occupy a comparatively humble position in the manufacturing markets of the world.

COPPER REFINING.

The electrolytic methods of refining raw copper were introduced into Germany in the year 1872, when the Mansfield Copper Company started a small refinery at Eisleben, in the Hartz Mountains. This refinery is still at work, although it has never grown to any marked degree, and in 1893 its estimated output only amounted to 734 tons. In 1876 the Nord-deutsche Affinerie, at Hamburg, was founded, and at one time this refinery was the most important in Germany. Difficulty in obtaining supplies of raw copper has, however, caused the usual check to development, and, although in 1895 this refinery produced 1,700 tons of copper, the present output is less than in the earlier years of its history. In 1878 another small refinery was established at Oker by the "Communion Hütten Werke," using the Siemens & Halske systems of working, but this refinery, though still in operation, is only of small size and importance. Other electrolytic copper refineries were established in the succeeding years at Berlin, Burbach, Frankfort, Schladern and Papenberg, and at the present date there are estimated to be nine such refineries operating in Germany. No reliable figures can be given for the output of these nine refineries, but it is not large, and the scarcity of raw copper suitable for refining by the electrolytic process checks all hopes of any expansion of the industry.

At Schladern the Elmore process for making tubes and sheets is worked with better financial results than in England, and the refinery is said to have 1,000 horse-power available for its operations. At Papenberg the Hoepfner process for extracting copper from its ores is worked in conjunction with a nickel process, cuprous chloride being used as the leaching agent. The installation here is comparatively recent, and it is yet too early to regard the process as a proved success. A process patented in 1886 by Siemens & Halske for achieving the same end did not yield satisfactory results on practical trial, and the Marchese copper extraction process, when tried at Stolberg, also proved a costly failure. The results obtained at the Papenberg works will, therefore, be awaited with interest by all electrometallurgists.

Although one or two of the German copper refineries have water power at their disposal, the majority of the nine refineries use steam or gas power for generation of the electric current.

ALUMINUM.

The industrial production of aluminum by electrolytic processes dates in Germany from 1886, when the Gräzel process was started at Hemelingen. This works operated from 1886 to 1890, producing fifteen tons of aluminum in the latter year. According to Borchers, the Gräzel process for the electrolysis of aluminum chloride or fluoride was practically worthless, and the aluminum actually made at Hemelingen was produced by the reduction of cryolite by means of magnesium—a process patented by Beketoff.

In 1890 the production of aluminum at Hemelingen ceased owing to the fall in price due to the competition of the Hall and Heroult processes, and the works at Hemelingen since that year have been devoted to other manufactures. In 1888 the Neuhausen Aluminium Company was formed by Swiss and German capitalists for operation of the Heroult process, and in 1889 a factory at Neuhausen on the Rhine was started, drawing power from the neighboring falls. Although this factory is on Swiss territory it will be more convenient to regard it as a German works, for the same company has lately extended its operations to Rheinfelden, the large power station on the banks of the Rhine, near Basle. The production of aluminum alloys by the Heroult process at Neuhausen proved successful, and by 1891 2,000 horse-power was employed in the manufacture. Improvements made in the original process by Kiliani, the Neuhausen company's chemist, led to the production of ninety-eight to ninety-nine and one-half per cent aluminum, and by 1895 the power requirements of the Neuhausen works had grown to 4,000 horse-power and the output of aluminum to 650 tons. Further developments were checked at Neuhausen owing to æsthetic considerations, and in 1899 the Rheinfelden works of the company (stated to have cost $558,000) were started. Five thousand horse-power is now utilized here in the production of aluminum and calcium carbide. Although 9,000 horse-power is available for the manufacture of aluminum in the two factories owned by the Neuhausen company, the whole of this is not devoted to the production of the metal, and the officials refuse to give any information concerning the actual output of aluminum during recent years. The *Mineral Industry* gives 1,300 tons as the production of the two factories in 1899, and it is quite possible that this large total was exceeded in 1900. The Neuhausen company is financially one of the most successful electrometallurgical companies in Europe, the dividend paid on its capital of $3,077,000 usually ranging from ten to thirteen per cent.

ALKALIES AND CHLORINE.

In Germany the time and ability of electrochemists were given at an early date to the solution of the problem offered by the electrolysis of chloride solutions, and one year after a distinguished authority in England had declared the industrial production of alkalies and bleach by electrolysis to be an economic possibility, such a process was in operation near Frankfort.

The early experiments were carried out with potassium chloride solutions, and the later developments of the electrolytic alkali industry in Germany have been chiefly in the direction of supplying all the requirements of the home market for potash salts, the bleaching powder being regarded as a by-product. The first plant of this character was erected at Griesheim, near Frankfort, in 1890, and the original installation at this place having proved successful, it was enlarged in 1892, and a second factory built at Bitterfeld in 1894, where cheaper fuel was available.

Both these factories worked what is known as the "Elektron" process for electrolysis of chloride solutions, but the process is unpatented and few details concerning it have been given to the public. It is, however, believed to be a process in

which diaphragms are employed to separate the anodic and cathodic compartments of the cells, and it therefore differs materially from the most successful English process—namely, the Castner-Kellner. The parent company owning the "Elektron" process has been financially successful in its operations, and sub-companies have been formed for operating the process in France, Russia and Spain. In 1898 and 1899 the Griesheim company paid dividends of sixteen per cent on its capital, but it must be remembered that this company carries on four distinct manufactures, and that alkalies and bleach are not the companies' chief products.

A second electrolytic alkali works was built at Bitterfeld in 1894 by the "Elektrochemische-werke Gesellschaft," a company promoted by the "Allgemeine Elektricitäts Gesellschaft," of Berlin. At this works a process similar to that of the "Elektron" company has been successfully worked down to the present date.

In 1898 this company extended its operations to Rheinfelden, where another works was built, and at the present moment these two factories have at their disposal nearly 5,500 horse-power for the manufacture of alkalies and bleaching powder. The parent Bitterfeld company has also promoted the flotation of a large number of sub-companies in Europe for operation of its process of decomposing chloride solutions. In 1898 the two German companies resolved to consolidate their interests, and nearly all of the European works using either the "Elektron" or the "Bitterfeld" process of manufacture are now under the technical and business control of the Griesheim company.

The "Elektron" process is also operated by the "Badische Soda u. Anilin Fabrik," at Ludwigshafen, and by the "Consolidierte Alkali Werke," at Westergehn, these companies working the process also under the control of the parent company at Frankfort. About 2,600 horse-power is available for the manufacture in these two works.

In 1896 the Deutsche Solvay Company commenced to work the Castner process at Oesternienberg, in Anhalt, and 1,500 horse-power (steam) is now utilized at this works in the production of alkali and chlorine products.

The Spilker and Löwe process was started at Leopoldschall in 1892 with 250 horse-power, but this process has not been very successful, and there is some doubt whether it is still being operated.

The German electrolytic alkali works thus number eight, and have over 14,000 horse-power available for the manufacture of caustic alkalies and bleaching powder. Ten years ago little or no bleaching powder was produced in Germany. In 1899 the electrolytic alkali works manufactured enough bleach to meet the home requirements, and sent 17,400 tons abroad.

As already pointed out, potassium chloride is the chief raw material of these German alkali works, and caustic or carbonated potash is their chief product. The decomposition of sodium chloride by electrolysis has been left in the hands of the English chemical manufacturers, who have cheaper supplies of brine and salt at their disposal.

BULLION REFINING.

Although the refining of gold and silver bullion by electrolysis does not demand large works or extensive plant, yet the capital sunk in this comparatively new industry is large, and the results obtained are eminently satisfactory.

Germany has taken the distinct lead in this branch of electrometallurgy and bullion refineries are in operation at Hamburg, at Frankfort and Pforzheim. The process used resembles in principle that for refining crude copper. The gold or silver bullion is used as anode in a suitable electrolyte, with thin plates of pure metal as cathode. On the passage of the current the silver or gold is deposited at the cathode, while the impurities either remain in solution or collect as the anode "sludge." Since gold bullion often contains palladium and platinum as impurities and these metals can be separated by comparatively easy methods from the "sludge," the electrolytic bullion refining process offers many advantages.

Limits of space will not permit many details of the processes to be given in this article. At Hamburg the Wohlwill process is used and gold-silver bullion is dealt with. At Frankfort the Moebius process is employed for refining silver bullion and silver-gold alloys. At Pforzheim a process known as the Diezel process is used for refining silver alloys containing copper. Copper nitrate is employed as the electrolyte in place of the silver nitrate used in the Moebius process.

The power utilized in the bullion refining industry is small, but in 1900 the value of the output of the Hamburg and Frankfort refineries was valued at $12,500,000.

HYPOCHLORITES.

The production and utilization of hypochlorite solutions for bleaching purposes have made greater progress in Germany than in any other European country. The electrolytic method of producing these solutions depends upon the electrolysis of potassium or sodium chloride in an open cell, with insoluble electrodes, at temperatures under twenty degrees centigrade. Charles Watt's historic patent of 1851 fully described the conditions necessary to obtain hypochlorite in the electrolytic cell, and later inventors have simply modified the form of apparatus used. The hypochlorite cells most widely employed in Germany are those of Kellner, Vogelsang and Oettel. The installations of these cells are chiefly to be found in the textile factories of Saxony, and in most cases the power employed for working them is not large. A large number of factories, however, have adopted the electrolytic method of producing bleaching solutions, and it is stated on good authority that over 1,500 horse-power is now utilized in this manner in the textile factories of southern Germany.

REMAINING MANUFACTURES.

Calcium carbide has been produced at several places by steam, water and gas power, but the recent fall in prices has quite disorganized the industry, and at the present moment most of the carbide works are shut down. With carbide selling in Germany at $40 per ton, there is little profit to be made by the factories even should they possess a cheap supply of power, and the closing of the carbide works at Lauffen, in Wurtemburg, is the latest example of the inability of German works to make a profit on carbide production.

The failure to uphold the Bullier carbide patents in Germany is held by some authorities to have been unfortunate, since it has led to over speculation and over production in the German industry.

Nickel is refined by an electrolytic process by Gustav Menne & Company, at Siegen, and the same metal is extracted from the Caledonian ore by the Hoepfner electrolytic process at Papenberg. The works at the latter place have been started comparatively recently, and it is yet too early to regard the Hoepfner process as a proved success. In 1900 the Papenberg works were stated to be producing one and one-half tons of nickel per day.

Magnesium is produced by the electrolysis of carnallite at Hemelingen, and sodium is produced under the Castner patents at Rheinfelden. The latter metal is also manufactured at Bitterfeld, and by Meister Lucius and Bruning, for private use, at Höchst-am Main. Chromium and chrome-iron alloys are manufactured by the Bitterfeld company. The larger German color works are known to be employing electrolytic methods for reduction and oxidation purposes in the manufacture of dyes and other organic products, but no details of these methods are allowed to be made public. Carborundum is manufactured on a small scale at Iserlohn under the Acheson patents.

METHODS OF SAFETY FOR THE OVERHEAD ELECTRIC TROLLEY SYSTEM.*

BY EDWARD MANVILLE.

[The following article is representative of the best practice in overhead railway construction in Great Britain. The author is a well-known and competent engineer, and his paper gives an excellent idea of the point of view of British engineers concerning electric railway construction.—EDS.]

The rapid growth in this country of late years of tramway systems operated electrically on the overhead trolley system has drawn public attention to its merits and disadvantages; and the corporation of Leicester having recently determined to install this system for the Leicester tramways, makes this occasion a peculiarly appropriate one for the consideration of such a subject by the association. The limits of this paper will not permit of a consideration of the whole of this somewhat extensive subject, and the author therefore proposes to confine himself to the methods which may be adopted for ensuring safety to the public when using the tramways or the streets in which they are laid.

For the convenient consideration of this paper it is divided into two parts:

1. Precautions to be taken to ensure solid construction.

2. Methods of ensuring safety should a breakdown occur.

PRECAUTIONS TO BE TAKEN TO ENSURE SOLID CONSTRUCTION.

Obviously it is most important that the overhead trolley system, when installed, should be of such solid construction and excellence of design that with a comparatively limited amount of inspection there shall be the smallest possible liability to breakage of the "live" conductors, or of parts carrying these, and of the entanglement of the trolley-wheel with the "live" conductor, the guard wires and their fittings.

In the first installations made on this system abroad both the trolley wire and the fittings supporting it were very light, and liable to fracture when subjected to comparatively small extra strains. It was originally the custom to use 0 B. & S. trolley wire of hard copper or phosphor bronze, having usually a tensile strength of about 24 tons per square inch section; consequently a trolley wire of the size mentioned would part when subjected to a strain of 4,560 pounds. The numerous accidents occurring from the use of so small a wire, and the fittings proportionate to its size, gradually caused the introduction of larger sizes of trolley wire, 0 wire being replaced by 00, having a breaking strain of about 5,230 pounds, and this size being itself superseded in the most modern installations by 000 wire, having a breaking strength of 6,580 pounds. As the wire used was increased in section, so the fittings supporting it were increased in size and strength, until the 000 wire, as installed to-day, has become an exceedingly strong and substantial structure.

No doubt the length of time that has elapsed in the adoption of the heavier wires, having regard to the accidents that undoubtedly occurred with the lighter ones, has been due to the fact that, especially in this country, it was believed that the heavier wires and fittings would be more perceptible to the eye than those of lighter character, but the actual installations of these that exist show conclusively that, at the height above the road level which they occupy, small differences in size are quite imperceptible, and certainly do not, so far as that reason is concerned, warrant the sacrifice of anything in the shape of the extra safety secured.

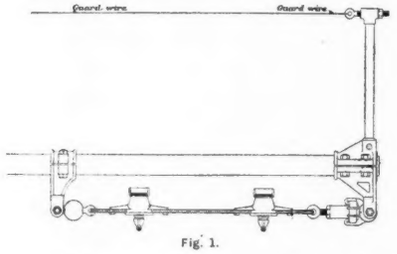


Fig. 1.

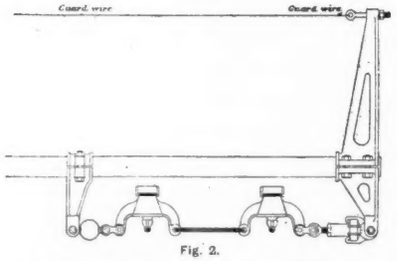


Fig. 2.

FIGS. 1 AND 2.—GUARD WIRES.

The provision of the heavier trolley wire does not necessarily mean a perceptible increase in the cost of the tramway system, since the extra copper thus put into the trolley wire effects a material saving in the cost of the insulated distributing wires laid underground.

In addition to making the trolley wire and the fittings directly supporting it of ample strength, it is, of course, equally necessary that the further fittings required to attach these to the bracket-arms or the cross suspension wires—if used—should be of equally substantial design, and the brackets themselves should be proportioned to have an ample margin of strength to withstand strains that may be thrown upon them through the trolley wire.

In the gradual growth from the 0 to the 000 construction there has been a tendency, while adapting the heavier trolley wire and fittings, to consider that the minor details used in the lighter construction were sufficiently strong for the heavier construction. For instance, five-eighths-inch bolts, which were universally used for the light insulating ears, are quite unsuitable for the heavy ears, and it is to be particularly noted that for this purpose no bolts of less than three quarters inch in diameter and of mild steel, should be used. In the same way the fittings on the steel street standards themselves, were used for the attachment of cross suspension wires, or for the securing of the bracket-arms to the poles, should be made of no less reliable material than malleable-iron castings, although one sees, in a good many instances, cast-iron fittings of this description used for the purpose, as formerly.

To ensure effective insulation of the trolley wire, the insulation should be double throughout. In the case of cross suspensions, the insulated bolt carrying the ear to which the trolley wire is attached is the first insulation; the second insulation forming a portion of the straining apparatus used to take up the sag from the cross span. In the case of bracket-arm suspension, the first installation, as before, should be the insulated bolt supporting the ear, and the second a layer of insulating material between the clamp to which the hanger is attached and the bracket-arm itself; but where flexible suspension is used in connection with a bracket-arm in place of the rigid suspension, the same arrangement of double insulation should be used, as in the case of the span-wire construction.

Next only in importance to the strength of construction of the trolley wire arrangements are the methods which should be adopted to ensure, as far as possible, the absence of contacts between falling telephone or telegraph wires and the trolley wire.

This is usually effected by placing guard wires parallel to and above the trolley wire, so arranged that there may be but little chance of falling telephone or telegraph wires evading the guard wires, and thus coming into contact with the trolley

*A paper read before the Incorporated Association of Municipal and County Engineers, at the annual meeting held at Leicester, England, 1901.

wire. The guard wire should be proportionately quite as substantially supported as the trolley wire, and should be of such section that the accidental contact of a

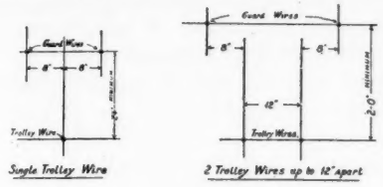


Fig. 3. Fig. 4.

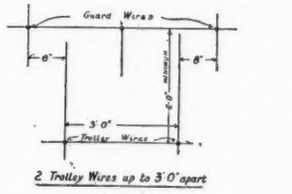


Fig. 5

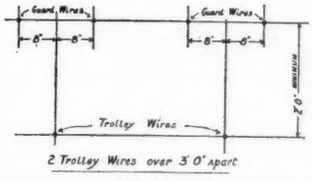


Fig 6.

FIGS. 3–6.—GUARD WIRES.

falling wire simultaneously with the guard wire and the trolley wire will ensure the operation of the circuit-breakers and other safety devices used, so that the current may be instantly cut off on that section of the trolley wire on which the accident occurs.

The guard wires should be of galvanized stranded steel, of not less than three-eighths inch in diameter, and supported in a thoroughly substantial manner. Fig. 1 shows the most approved form of flexible bracket-arm suspension now being installed on the straight lines; and Fig. 2, modifications of the same form of suspension when used on curves. In both cases the supports for the guard wires are also shown. In the latter case, *i. e.*, the method of construction for curve work, it will be noted that the fittings are very much strengthened as compared with those used on straight lines, which used not to be the case in earlier installations.

ARRANGEMENT OF GUARD WIRE.

To ensure the better protection of overhead telegraph and telephone wires from contact with the trolley wire, great consideration has been given to the best methods of arrangement of the guard wires in reference to their position to the trolley wire, and the latest regulations issued by the post-office authorities in this respect probably represent the best arrangements.

(*a*) *Telegraph or telephone wires crossing above trolley wires.*

1. When there is only a single trolley wire or two trolley wires not more than 12 inches apart, two guard wires should be erected, as shown in Figs. 3 and 4.

2. When trolley wires are more than 12 inches apart, and do not exceed three feet, the guard wires should be increased to three in number, as shown in Fig. 5.

3. When the distance separating the trolley wire exceeds three feet, each wire should be separately guarded as shown in Fig. 6.

(*b*) *Telegraph or telephone wires parallel to trolley wires.*

In all cases in which telegraph or tele-

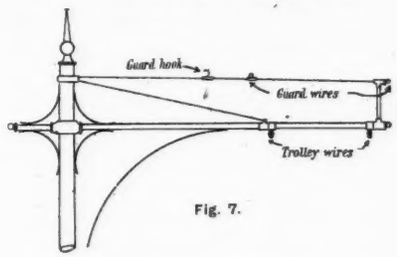


Fig. 7.

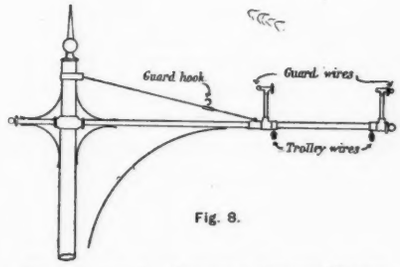


Fig. 8.

FIGS. 7 AND 8.—SHOWING GUARD HOOKS.

phone wires and trolley wires are parallel, and within 30 feet of one another, suitable hooks should be fixed on the arm, stay, or on the span wire to support the guard wires, which should be erected on similar lines to the above. This is shown in Figs. 7, 8 and 9.

These last arrangements, of course, refer only to a case where the telegraph or telephone wires are at a higher elevation than the trolley wires, so that broken wire may be blown transversely across a trolley wire. Where, however, the telegraph or telephone wires are at or about the same height as the trolley wire, when there would be no possibility of this happening, the guard wires need not be provided.

(*c*) Where the telegraph or telephone wires are so close to the trolley wires as to render the foregoing protection insufficient, the guard wires should be cross-laced, as shown in Fig. 10. This cross-lacing forms a hammock netting, on to which the broken telegraph or telephone wire would fall, and is a very effective protection.

The same arrangement can be used with great advantage where a number of telegraph or telephone wires are crossing the trolley wires, and not running parallel to them, in which case the "hammock" can be suspended under the telegraph or telephone wires from pole to pole at the point where they cross the trolley wires. In such cases, however, it is probably better to arrange with the post-office authorities or the telephone company that the mass of wires shall be dispensed with and an insulated cable containing all the conductors be substituted therefor—a matter not of very considera-

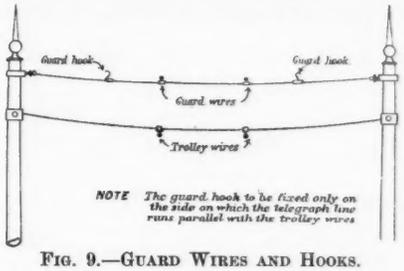

Guard hook
Guard hook
Guard wires
Trolley wires
NOTE The guard hook to be fixed only on the side on which the telegraph line runs parallel with the trolley wires

FIG. 9.—GUARD WIRES AND HOOKS.

ble expense, seeing that only one span of the telegraph or telephone system is involved in such an arrangement.

With the above arrangements effectively carried out, it is not very probable that a falling wire will come in contact with the "live" trolley wire, and it is highly improbable, should it do so, that it will fail to make contact with one or other of the guard wires. At the same time that this happens the falling wire would either be fused off at once, or failing this, would operate one or other of the safety devices referred to hereafter.

To ensure the operation of the safety devices by the short-circuiting of the trolley wire on the guard wire, it is essential that the guard wire should be in thoroughly good electrical connection with the

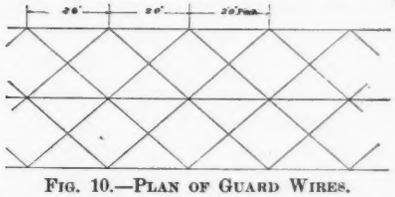


FIG. 10.—PLAN OF GUARD WIRES.

track, and this should be effected by the direct connection of the base of the steel street standard to the nearest rail in at least one and preferably two cases in each detached length of guard wire. It is somewhat curious to note in this connection that in the older installations it was considered desirable to insulate the guard wires in place of effectively earthing, as is now the recognized and only safe practice.

ROLLING STOCK.

Danger may arise in two respects from the rolling stock:

1. Entanglement of the trolley arm with the overhead construction.

2. Shocks to passengers.

The entanglement of the trolley arm with the overhead construction in older installations was a constant source of accident. This has been, to a very large extent, overcome by the proper guarding of the trolley-wheel, so that in the event of this leaving the trolley wire and coming in contact with the cross suspensions, bracket-arms or other fittings, it can hardly become entangled with any of these; and this is further helped by the trolley arm being so arranged as not to rise further than a predetermined limit when off the trolley wire.

Perhaps there is more liability to accident and more difficulty in guarding against it in connection with the trolley arm than with any other portion of the system; and although the substantial construction of the overhead system as previously described will almost certainly prevent any disturbance to this should the trolley-wheel become entangled, it is in that case difficult to prevent the trolley head being itself pulled off the trolley arm. For this reason the trolley arm should be long enough to carry the head free of the car, so that, should it be dropped, it will fall clear of the passengers.

Electric shocks to passengers carried on the cars are very rare, and should not occur at all if the precaution is taken of thoroughly "earthing" all metallic parts of the car, including the trolley standard itself.

The springs used to give the trolley arm the requisite upward pressure against the trolley wire, if arranged externally, might also be a source of annoyance to passengers, and these springs should therefore be arranged within the trolley standard. This has been done very effectively lately in connection with a tramway with which the author is concerned, and will no doubt in the future be a standard arrangement. Fig. 11 shows a complete drawing of a trolley standard, and there is on the table a sample of a patent form of swiveling, shielded trolley head which has been found very effective in practice.

METHODS OF ENSURING SAFETY SHOULD A BREAKDOWN OCCUR.

If, notwithstanding the substantial construction advocated, a trolley wire should break, or if telegraph or telephone wires should come in contact with the "live" trolley wire, it is essential that means should be provided for immediately rendering that particular section of the trolley wire inoperative by automatically disconnecting it from the generator. In the earlier installations, and even to a certain extent to-day (abroad), the trolley wires and feeders were so interconnected and unguarded that an accident to one part of the system either produced serious results or involved the shutting down of a large part of the system on account of one local fault. To guard against this and to enable suitable safety devices to be effectively operated, the trolley wire should be divided into sections not exceeding half a mile in length, and as few of these sections as possible fed through any single feeder proceeding direct from the source of supply.

FIG. 11.—TROLLEY STANDARD.

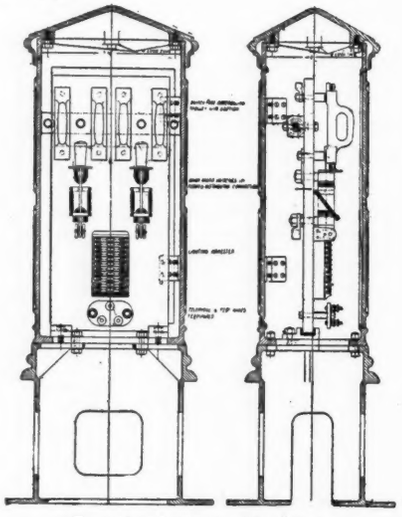


FIG. 12.—SECTION CUT-OUTS.

In between the adjoining sections of the trolley wire properly designed section pillars should be connected, enabling any section of the up and down trolley wire to be disconnected from the circuit while continuing the supply to the remainder. The section pillar should be arranged so that the discontinuance of the supply of current to the particular section of trolley wire may be brought about either by the melting of fusible connections, the operation of hand or automatic switches, or a combination of these.

The ends of the feeders supplying the fewest possible number of these sections should be suitably protected in the generating station by an automatic switch, arranged to open the circuit when a moderately larger quantity of current than the normal passes through its widenings. Then, should a telegraph or telephone wire fall across the guard wire, and, at the same time, by accident come into contact with the "live" trolley wire, a sufficiently large flow of current will take place through the short-circuit thus produced to either melt the fuse or operate the automatic switch in the section box, in which case that particular section of the trolley wire only will be automatically put out of action, or, failing the effective action of the fusible cutout or automatic switch in the section pillar, the circuit-breaker at the end of the feeder in the generating station will open, stopping the supply of current in that case to the section of trolley wire on which the accident has occurred, and also the other sections of trolley wire fed by the same feeder.

It will be obvious that in carrying out such an arrangement the sections of trolley wire fed from one feeder must not be interconnected with the sections fed from the other feeders, but the section boxes themselves should be provided with switches which will enable the gaps to be bridged over between adjoining trolley wire sections, fed off separate feeders, when a faulty section has had to be cut out.

Fig. 12 shows the general arrangement of a section pillar now in almost universal use on tramways in this country, varying only in the details of arrangement. In the figure in question fusible cutouts are used for connecting up the various trolley wire sections to the distributor, and switches are provided for connecting up the distributor and the feeder. The fusible cutouts are arranged to be used as switches when it is required to temporarily disconnect any trolley wire, and the switches are available for disconnecting the distributor or feeder for testing or other purposes.

The feeder pillar also contains the terminals for the reception of the ends of telephone cables—the instruments themselves being carried on the cars—and terminals for the ends of the Board of Trade test wires, and in case of any special safety device being used, such as the "Quin" automatic switch, described later on, the

section pillar should also be arranged to contain any such fitting.

The above arrangement may be described as the more usual arrangement adopted up to date, and while, if properly proportioned, it would be effective for the cutting out of trolley wire sections

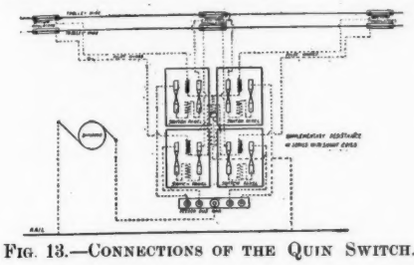


FIG. 13.—CONNECTIONS OF THE QUIN SWITCH.

when telegraph or telephone wires have come in contact with them, is not generally applicable to accidents which might occur from the breakage of a trolley wire the ends of which would hang down to the roadway, and which, unless the ends came into actual contact with the rails, might not convey sufficient current to open the circuit-breakers or melt the fuses, and, therefore, might remain "alive," to the danger of any animal or person coming in contact with them.

To meet this exigency several devices have lately been designed to ensure the circuit being opened as surely when a trolley wire is broken as when it is short-circuited to the guard wires through a fallen telegraph wire. These devices may be divided into two classes:

1. Automatic switches requiring a pilot wire for each section of trolley wire, carried the whole length of the half-mile section.

2. Mechanical devices brought into action by the severance of the trolley wire.

The best known example of the first of the above-mentioned types, namely, automatic switches requiring a pilot wire, is that designed by Mr. Quin, of Blackpool, and in use upon the electric tramway system there. This device involves the trolley wire being divided up into sections, which are not, as is otherwise usual, interconnected with the adjacent ones. Each of these automatic switches has a main solenoid coil in series with it, and is so arranged that, should the current passing through this coil exceed the predetermined amount for which it is adjusted, a plunger within the solenoid is drawn up against two catches and releases the switch, so that in case of short-circuiting or excessive current the line is automatically cut out. At the back of this switch there is a shunt solenoid coil which is in series with the pilot wire, which may be run either overhead, on insulators, or as an insulated conductor underground at the end of the trolley wire section the switch is intended to control, and is there connected to the trolley wire. So long as the pressure between the trolley wire and the rails remains at about 500 volts, this shunt coil holds up the plunger within it, but if the line were to break and the pressure thereby be cut off from the pilot wire and, therefore, from the shunt coil, the plunger would be released, falling on to two catches and operating the switch, thus automatically cutting off this section of the trolley wire. In this way this particular switch takes both the place of the fusible cutout previously referred to and, in addition, ensures the current being cut off from the trolley wire should the wire be broken.

It has, however, one disadvantage, and that is that no current can be put on to any of the sections of the trolley wire until the switch has been set by hand once the pressure has been taken off the line, so that after shutting down at night it is necessary for an official, on the first car proceeding out in the morning, to stop at each section pillar and set the switch for the succeeding section before the car can

FIG. 14.—EARTHING WIRE DEVICES.

proceed over it, while, should there be an accidental short-circuit during the hours of operation of the tramway which might for a moment cut off the current entirely from the power-house, it would again be necessary for all the switches to be reset by hand as the cars proceeded. A diagram of the connections of the Quin switch is shown in Fig. 13.

The second type—that is, mechanical devices for cutting off the current and coming into operation by the severance of the trolley wire—depend for their action on the short-circuiting of the trolley wire to the rails, thus either melting the fusible cutouts or opening the circuit-breakers as previously described, in the case of any ordinary excess of current taking place. So far as the author is aware, the only devices of this description that have yet been put into operation are those designed by Messrs. Blackwell & Company.

In each form of this apparatus the necessary short-circuit is produced by a short lever being pulled over either against the bracket-arm, when either the rigid or flexible suspension type of bracket construction is used, or against a loop hanging from a special earthing wire carried over the trolley wire when the cross suspension method of construction is in use.

Fig. 14 shows one form of this device as adapted to the flexible suspension bracket-arm construction. From this figure it will be seen that the lever remains in a vertical position so long as there is no pull on the short stay wire connecting the short end of the lever with the trolley wire. Should the trolley wire break at any point along the span, a considerable pull is exerted on the short end of the lever which brings the longer end immediately into contact with the bracket-arm, exerting considerable pressure between these two points, and ensuring a good contact to earth with a consequent short-circuit and sufficient flow of current to melt either the fuses in the section box or open the circuit-breaker in the power-house. The extreme simplicity of this device has much to recommend it. The same device might be conveniently used for safe-guarding telegraph or telephone wires where they cross the trolley wire, and where they are not in sufficient numbers to make it worth while substituting an insulated cable, as recommended in an earlier part of this paper. Fig. 15 shows the modification of this device under such circumstances.

The telephone pole, at points where the wires cross the trolley wires, must be permanently connected to the rail. The lever shown in the figure is fixed to each insulator by means of a clamp, and the weighted end is attached to the telephone wire. The stirrup shown is connected either through the pole to the rail, or, should the pole be a wooden one, through a special wire attached to each stirrup and connected to the rail. Should the telegraph or telephone wire break, the weighted end of the lever drops, and brings the other end into contact with the stirrup, thus earthing the broken wire. If the broken wire has come into contact with the trolley wire, sufficient current will flow through the trolley wire to the telephone wire to either melt the fuses in the section box or open the circuit-breaker in the power-house, or, alternatively, to fuse off the telephone wire itself. In this case the weight of the breaking telegraph or telephone wire would

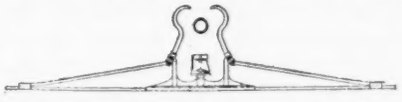


FIG. 15.—MODIFIED EARTHING DEVICE.

assist the movement of the weighted end of the lever.

The author trusts that this description of means for rendering the overhead trolley system safe has not taken up too much of the time of the association, and his excuse must be that the increasing number of installations of this system in the country is such as to demand the careful consideration of all concerned in eliminating, as far as possible, the chances of accident.

Views, News and Interviews.

It is said that the manager of the Cuyahoga Telephone Company, in Cleveland, Ohio, has established a public information bureau, with a young woman in charge. This young woman is supposed to answer all sorts of questions. Of course, some of the questions can be answered offhand, but many of them require to be looked up in reference books. In this case the telephone number of the enquirer is taken and the answer is sent later on. The bureau has a special number and is fitted up in a large room with all kinds of books for reference. It is said that many absurd questions were asked at first, but now the bureau has reached a business basis. The operator is frequently asked the location of fires, and during the baseball season the scores were asked for many times a day.

A ridiculous damage suit has just been decided in London. Our contemporary, the London *Electrical Review,* indulged in some humorous remarks concerning a variety of patent perpetual-motion machine devised by one Pole, and by him called "Poleforcia." He brought suit in the King's Bench Division of the Court of Chancery to recover damages for alleged libel. Mr. Pole's machine was the "double-energizing momentum engine," of which readers of daily newspapers in this country have doubtless heard before. After hearing evidence and arguments, which were naturally extremely amusing to the members of the engineering profession present, the jury immediately returned a verdict for the defendant with costs. Outside of its humorous aspect, the case is of some importance in virtually assuring the liberty of the technical press to expose some nonsensical inventions.

A unique story comes from Pennsylvania. A certain Bohemian truck farmer had been extraordinarily successful in the early marketing and in the quality of the vegetables which he produced and had in this way caused his neighbors to become envious. At the same time the officials of the trolley company, whose wires passed his field, began to notice that an extraordinarily large amount of electricity was consumed in the operation of its cars and lighting business. The dynamos had to be worked overtime. By a strange coincidence, it is said that the greater the troubles of the trolley company the greater was the prosperity of the producer of vegetables. At last the affairs of the trolley company reached such a state that men of science were summoned to solve the problem. One of these men accidentally heard of the marvelously fine crops raised by the farmer. He made an investigation and found, it is alleged, that the trolley feed wire had been tapped ingeniously and that a fine network of wires ran through the soil of the truck farm, which solved the mystery. It is said that the trolley company has now brought suit against the farmer for damages for taking electricity. How many kilowatts are required to ripen a turnip is not stated.

The Hon. Edward F. Jones, of Binghamton, N. Y., formerly Lieutenant-Governor of New York state — the identical Jones who made himself famous because he paid the freight—has discovered that a telephone can be turned into a burglar alarm at small expense. He ties a string to his telephone receiver, which is downstairs in his house, and brings the end of it up to his bedroom in such a way that he can joggle the receiver at night should he be visited by burglars. The flashing of signal lights at the exchange switchboard at unseemly hours will be understood by the operator to indicate burglars and prompt information sent to the police. Mr. Jones claims that his invention works to his entire satisfaction.

Sir Hiram S. Maxim gives an interesting instance of the attraction which certain sounds have for mosquitoes. One of the electric lamps which he put up at Saratoga Springs, N. Y., in 1878, emitted a musical note; or, rather, the note proceeded from the box containing the dynamo machine under the lamp. One evening, while examining the lamp, he found that everything in the immediate vicinity was covered with small insects. They did not appear to be attempting to get into the globe, but into the box that was giving out the musical note. A close examination of these insects showed that they were all male mosquitoes. Although there were certainly 200 times as many female mosquitoes on the ground as males, not a single female mosquito was found to have been attracted in the least by the sound. When the lamps were started in the beginning of the evening every male mosquito would at once turn in the direction of the lamp, and, as it were, face the music, and then fly off in the direction from which the sound proceeded. It then occurred to him that the two little feathers on the head of the male mosquito acted as ears, that they vibrated in unison with the music of the lamp, and as the pitch of the note was almost identical with the buzzing of the female mosquito the male took the music to be the buzzing of the female.

Book Reviews.

"Electrical Engineering Formulæ." By W. Geipel and M. Hamilton Kilgour. 3 by 4½ inches. Flexible leather. 828 pages. Many illustrations. London. The Electrician Publishing Company. Furnished by the ELECTRICAL REVIEW at $3.00.

This little book is a second edition, revised and enlarged, and is doubtless destined to continue the favorable impression which was made by the first edition. It contains a very large amount of useful information and many tables, and forms an excellent compendium of British practice in electrical engineering.

"Shop and Road Testing for Dynamos and Motors." By E. C. Parham and John C. Shedd. 5½ by 8 inches. 627 pages. 211 illustrations. Cloth. New York. *Electrical World and Engineer.* Supplied by the ELECTRICAL REVIEW at $2.50.

The sub-title of this book is "A Practical Manual for the Testing Floor, the Car Barn and the Road." A good deal of the book is given over to an introductory part of the general theory of electrical machinery, but the testing part itself is a valuable and altogether excellent treatise. This is the kind of book that ought to be found in the car barn and the power-house—not in the bookcase, but out on the work bench where it will be used.

"Electrical Catechism." By George D. Shepardson. 6½ by 10 inches. 403 pages. 1,516 illustrations. Cloth. New York. American Electrician Publishing Company. Supplied by the ELECTRICAL REVIEW at $2.00.

The subject-matter of this book is a revision and enlargement of an electrical catechism which has been running for the last five years in electrical publications. It is an attempt to answer the innumerable questions which continually come up in the minds of those who come into contact with electrical applications. A copious index gives great additional value to the work, and the 1,520 questions contained in it are answered in a plain, practical way that should commend them to the general reader.

"A Handbook for Apprentice Machinists." Edited by Oscar J. Beale. 4 by 6 inches. 141 pages. 86 illustrations. Cloth. Published by the Brown & Sharpe Manufacturing Company. Supplied by the ELECTRICAL REVIEW at 50 cents.

The well-known manufacturing company which has published this little book planned its subject-matter for the use of its own apprentices, but finding that there appeared to be a demand for such a work, decided to publish it for general circulation. It presents points which should be learned early and remembered late by the apprentice or machinist. Naturally, it is eminently practical in style and contains a great deal of information that is of real and genuine value.

The Telephone Industry in the United States.

The Present Great Extent and Growth of the Telephone Business.

THE HISTORY of the telephone in the United States has been one of great interest and has been marked by developments of an almost spectacular character. The telephone was invented by Professor Alexander Graham Bell in 1875, and was patented the next year. In 1877 the instrument was brought to the attention of business men but met very little encouragement. Indeed, it was stated as the deliberate opinion of men prominent in telegraph and business circles who had examined the invention carefully with reference to its utility that it could never be of practical use in business affairs!

The business was organized and developed under the admirable management of the late Gardiner G. Hubbard, who started the telephone industry by appointing agents in the principal cities of the country and granting licenses for terms of various lengths. The first telephone lease was issued in June, 1877, and by January 1, 1878, somewhat over 5,000 telephones had been manufactured and delivered to agents and licensees for use on private lines. As early as this time test conversations had been successfully carried on between New York and Philadelphia, and Philadelphia and Washington, this distance representing about the limit of telephone conversation with the early magneto instruments. The first central office equipment was devised and put in use in 1879, and this date may be said to be the beginning of the telephone industry. To quote from an article by Mr. George C. Maynard, in the ELECTRICAL REVIEW of January 12, 1901:

"The machinery consisted of long rows of loud ringing bells (one for each wire) with a plug switch for making the necessary connections, and a number of operators' tables entirely separated from the switch. One or more switchmen were employed to watch the bells, switch the wires to an operator sitting at a table and shout out the full names of the individuals, firms or officials to be connected. The cost of this equipment, with capacity for operating 500 wires (2,500 subscribers), was $2,310."

The company then inaugurated now has an exchange service numbering over 9,000 subscribers.

The central organization of the Bell Telephone Company was completed at about this time, and the company was reorganized in 1880. Recently a consolidation of the interests of the company formerly operating the long-distance telephone lines, and the American Bell Telephone Company, whose business consisted in licensing subordinate concerns to do business in different sections of the country, has been effected, and the new central organization, known as the American Telephone and Telegraph Company, now represents that large consolidation of interests known as the Bell companies. Below will be found comparative figures of the present status of this company, and of the independent companies which are its immediate business rivals.

The fundamental patent on the speaking telephone expired by limitation in March, 1893, and immediately a number of concerns undertook the manufacture of telephones, the basic patents no longer preventing the construction and sale of these instruments. In the early part of 1894 there were several independent operating companies in existence in some of the smaller cities, these having been organized to meet the demand for telephone facilities at reduced rates. The matter seemed to take root particularly in the central states, and it is here that the independent movement has grown and flourished more than elsewhere, although at present it extends to every state of the Union with the exception of Nevada and Rhode Island, and in these states it is understood that independent companies are organizing. The history of the independent movement was admirably recounted by Judge James M. Thomas, president of the Independent Telephone Association of the United States, in the ELECTRICAL REVIEW for January 12, 1901.

A third movement should perhaps be spoken of here, although strictly speaking it is a part of the general independent development. This is the introduction of automatic telephone exchanges, in which the services of operators are dispensed with and electrically operated automatic switches used to perform the necessary connections and disconnections between subscribers.

In addition to the various forms of exchange service mentioned above, the telephone has been very largely extended to replace the speaking tube and to furnish intercommunicating systems for such establishments as hotels, factories, large works and offices desiring the advantages of immediate electrical communication from department to department. For the most part this work has been carried on by the independent manufacturers, although in some cases hotels have been supplied with intercommunicating systems by the Bell companies, and in the larger cities what is known as the "branch office system" is very largely in use in offices connected with the Bell company's exchanges. By this system the various departments of a large concern are provided with telephones connected with a common central office, which, in turn, is connected by one or more trunk lines to the nearest telephone exchange. For intercommunicating work a number of excellent automatic systems have also been devised and are in successful use.

In attempting to summarize the present extent of the telephone industry many difficulties have been encountered, and the data given below are believed to be as accurate as any that can be had at the present time, although it is probable that the figures given for the extension of the independent companies are considerably under the truth. The tables represent the best information that can be had at present, and are here given as a reliable summary of the situation on October 1, 1901.

INDEPENDENT TELEPHONE COMPANIES AND SUBSCRIBERS.

States.	Towns Having Independent Exchanges.	Subscribers.
Alabama	26	6,423
Alaska	4	340
Arizona	9	1,019
Arkansas	34	2,985
California	61	8,750
Colorado	37	1,964
Delaware	15	3,336
District of Columbia	3	311
Florida	21	3,297
Georgia	62	10,962
Hawaii	1	111
Idaho	5	495
Illinois	197	21,667
Indiana	192	88,669
Indian Territory	15	1,478
Iowa	146	32,364
Kansas	59	9,917
Kentucky	66	11,365
Louisiana	17	3,228
Maine	32	2,991
Maryland	40	14,360
Massachusetts	31	11,925
Michigan	140	41,734
Minnesota	71	19,102
Mississippi	44	8,842
Missouri	111	36,245
Montana	17	1,449

Nebraska	31	3,230
Nevada	..	....
New Hampshire	19	3,826
New Jersey	45	8,080
New Mexico	11	1,029
New York	166	20,470
North Carolina	71	9,931
North Dakota	19	2,108
Ohio	226	155,664
Oklahoma	17	2,154
Oregon	29	13,775
Pennsylvania	198	64,604
Rhode Island	..	....
South Carolina	49	5,898
South Dakota	30	2,432
Tennessee	80	8,360
Texas	80	8,144
Utah	1	....
Vermont	29	1,608
Virginia	59	19,271
West Virginia	54	9,734
Washington	12	1,684
Wisconsin	121	20,868
Wyoming	5	488
Totals	2,811	708,717

It should not be forgotten in connection with this table that it represents only the exchange companies operating on an independent basis, and that the number of telephones made by independent manufacturers and actually in use for intercommunicating purposes, private lines, farmers' and cooperative systems, etc., is somewhat in excess of 450,000. A conservative estimate lately made from data furnished by manufacturers gives the number of such telephones in use at 490,000, and this may be taken as a fair basis of comparison. In some states the number of independent telephone exchanges considerably exceeds that of the Bell exchanges, this being true in Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, Missouri, Kansas and perhaps in several others.

From the best information at present obtainable the investment represented in the independent telephone interests, including toll lines and manufacturing establishments, at this time is from $125,000,000 to $150,000,000.

The Bell Interests.

Turning, now, to the Bell telephone interests, it is found that the licensee companies of the American Telephone and Telegraph Company are fifty-one in number and operate at present a total of about 1,500 exchanges, with about 1,080,000 subscribers connected. The latest accurate figures obtainable are those for January 1, 1901, which showed that at that time this company was operating a total of 1,354,202 miles of wire and was giving employment to 33,000 people. It was at that time handling a total of very nearly 2,000,000,000 calls per year, the average daily number of calls per station through the United States being 7.1.

The capital invested in the Bell interests is very large. The capitalization of the American Telephone and Telegraph Company is $100,000,000, the capital stock at present quotations being valued at $160,000,000. The stock and bonded indebtedness of the licensee companies represent as much more, so that the total investment in this branch of the telephone industry may be set at $320,000,000.

The Total Telephone Investment.

Figures of the automatic telephone industry are included in the independent estimate given above. It will be seen from these figures that the total of the industries in the United States at present may be represented as follows:

	Number of Exchanges.	Capital Invested.	Telephones Connected.
Bell	1,500	$320,000,000	1,080,000
Independent	2,811	150,000,000	708,717
Farmers' lines, Intercommunicating systems, etc. (Ind.)	....	....	490,000
Totals,	4,311	$470,000,000	2,278,717

Comment upon such figures as these is unnecessary. The industry has had actually only twenty-two years in which to develop. The telephone has become an absolute necessity, and its extension and growth have been proceeding lately at an accelerating rate. While no forecast of its future is possible, yet it is not difficult to see that the next twenty years will probably show an extension very much greater than that exhibited in the first two decades of this extremely important branch of the electrical field.

Telephone Manufacturing Interests.

Manufacturing interests form a large and important part of the general business of telephony. That of the Bell corporations is centred in a single concern, the Western Electric Company, which conducts an enormous business, requiring two large factories in the United States and several abroad.

In the independent field there are about sixty manufacturing concerns making telephone, switchboard and auxiliary apparatus. Several powerful corporations are engaged very largely in making telephone wires and cables, while a very large number of companies engage either wholly or in part in the manufacture of specialties for the telephone field. In all, these manufacturing interests represent an investment of many millions and give employment to thousands of operatives of all grades. Their output is almost uniformly excellent, and much of it represents the highest grade of telephone material built anywhere in the world.

Trams and Telephones of Bangkok.

United States Consul-General Hamilton King has sent the following: Bangkok enjoys the advantages of an electric light plant and of an electric tram line six miles long, and is now laying a second line of equal length. These are all private enterprises. The service of the two plants already in operation is fairly good, and, together with the introduction of the new tram line, they mark a decided advance in the development of the city.

The telephone system of Bangkok is decidedly bad. It is owned by the government and forms part of the postal-telegraph department. There are some 200 instruments of the Keiser-Schmidt, Berlin, make in the city at present, and to any one who has ever attempted to use one of these, it is evident that even this limited number stands as a monument to the patience and good nature of the citizens. Better results are produced every day by the American boy with his tow-string and the resonant bottom of a tin can.

Yet this is a city of magnificent distances, and, taking into consideration the manner in which the palace and its surrounding public buildings are separated from the legations and consulates, the distance of the walled city from the residences of most of the foreigners, of the large foreign firms one from the other, of the old palace group from the new palace in its beautiful park, and the entire division of the old city from the new by the river, which is crossed by no bridges, few cities are better fitted to appreciate a first-class telephone system. The Siamese are a people who know a good thing when they see it, and they, together with the long-suffering members of the foreign community, would generously patronize a good telephone system, were it at once established. There should be at least 1,000 instruments in use in the city, in place of 200, and this number without question would be largely increased as the fact was borne in on the public that a telephone was invented to save time and for convenience.

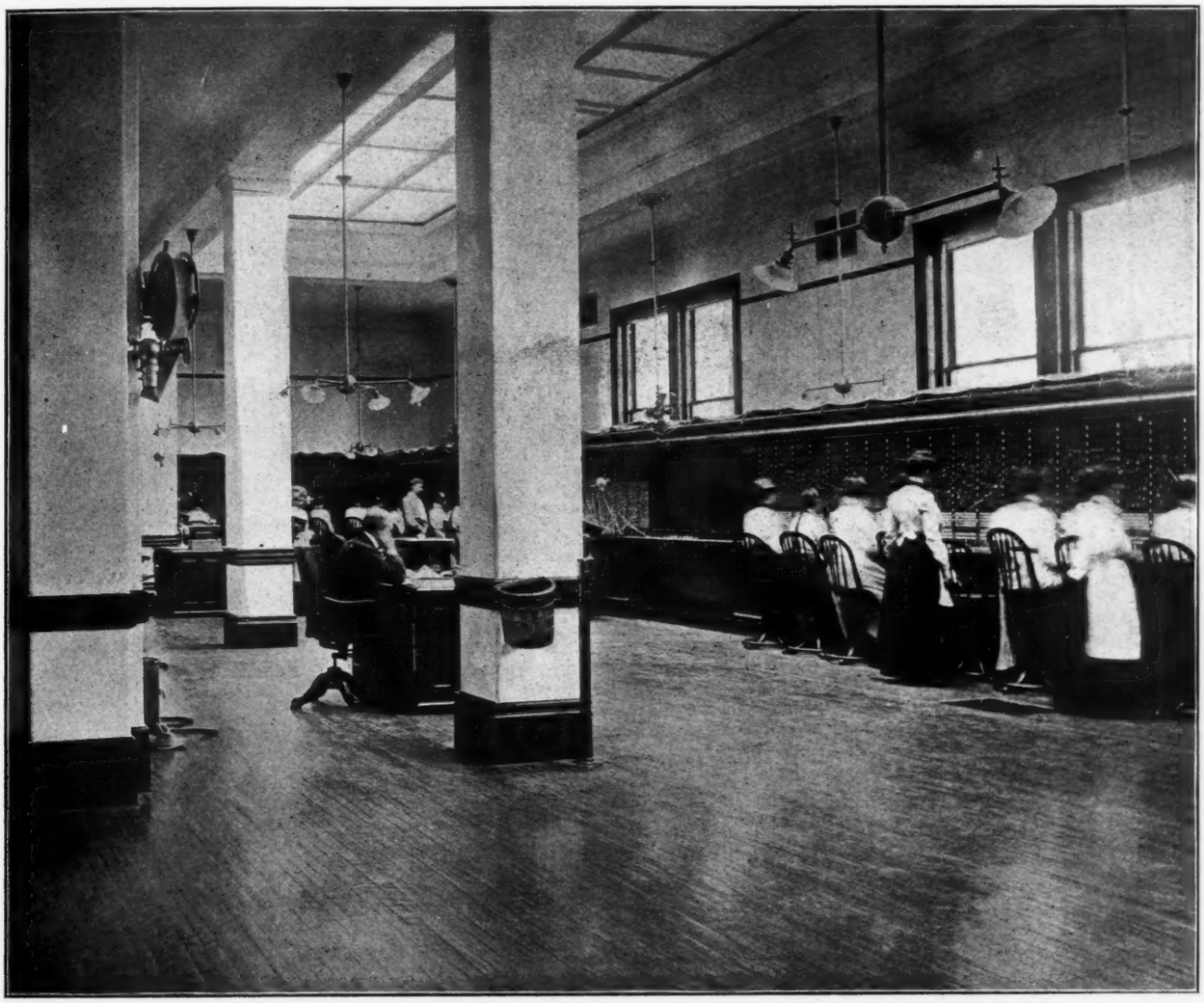
There would seem to be an opening for the introduction of an improved system in Bangkok, and with the present condition of affairs, a few first-class instruments in some of the public buildings might soon work a change in the entire city.

The Brooklyn Rapid Transit Company will spend about $3,000,000 during the present winter for improvements. In these improvements a $500,000 power-house, to be erected at Third avenue and First street, South Brooklyn, is included.

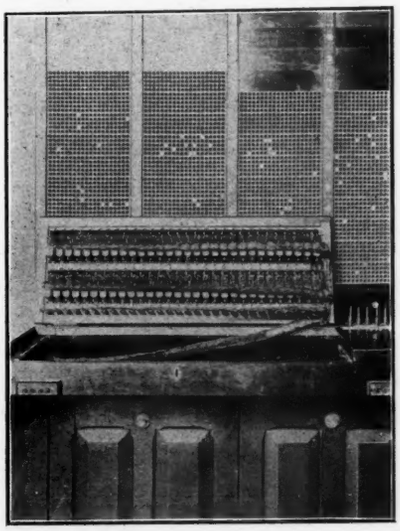
Some Typical Telephone Exchanges.

THERE are illustrated on these pages three examples of telephone exchanges which may be regarded as typical of the best practice of the independent, Bell and automatic fields.

The magnificent exchange of the New York Telephone Company, one of the licensees of the American Telephone and Telegraph Company, in Eighteenth street,

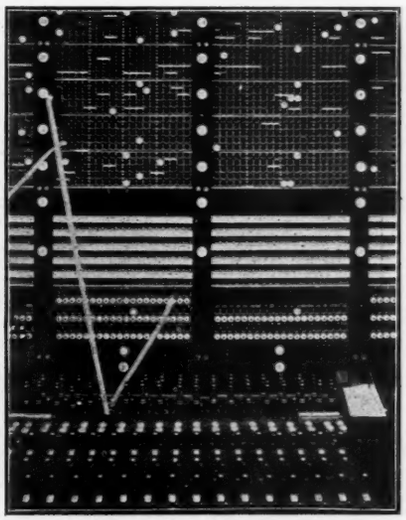


A Corner in the Main Switchboard Room, Eighteenth Street (Bell) Telephone Exchange, New York City.

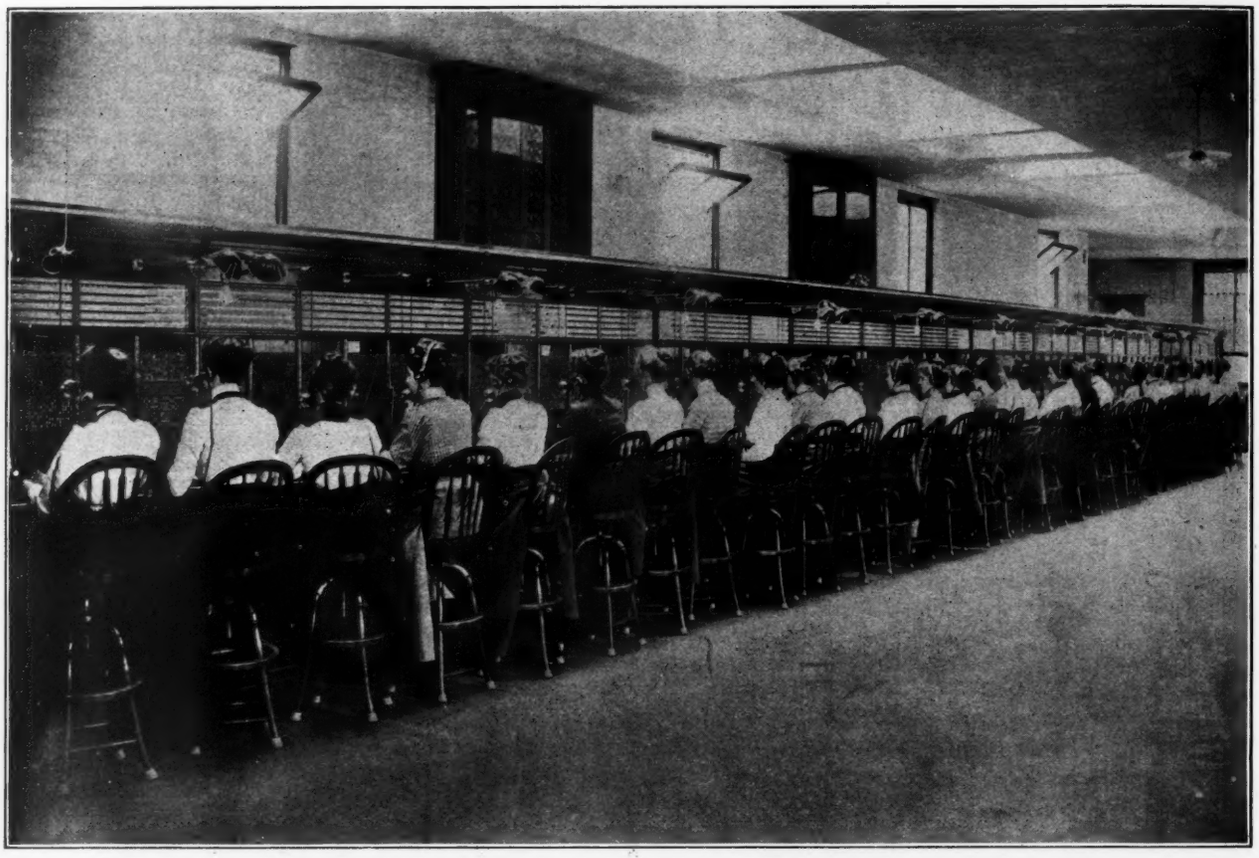


Detail of the Ringing Keys.

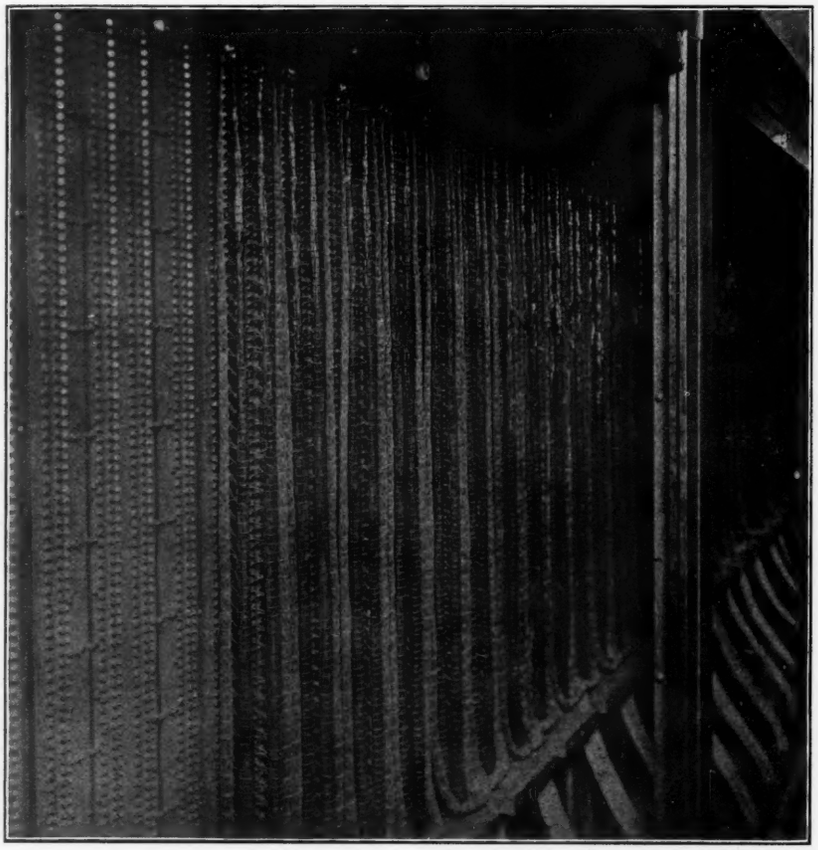
Cable Crossing in the Eighteenth Street Telephone Exchange.



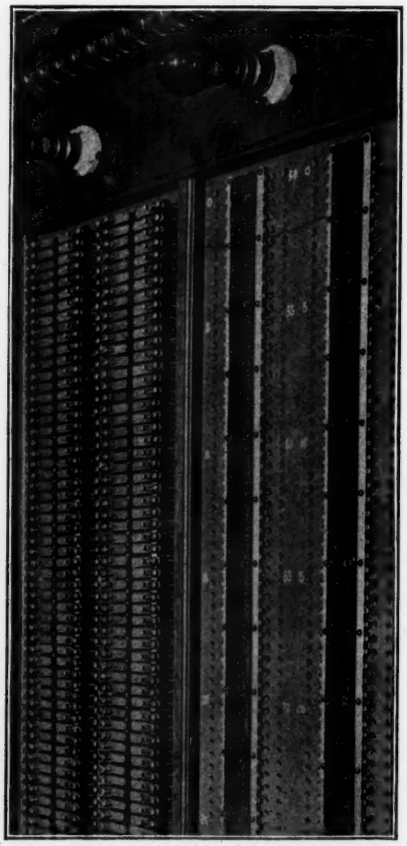
Detail of the Switchboard.



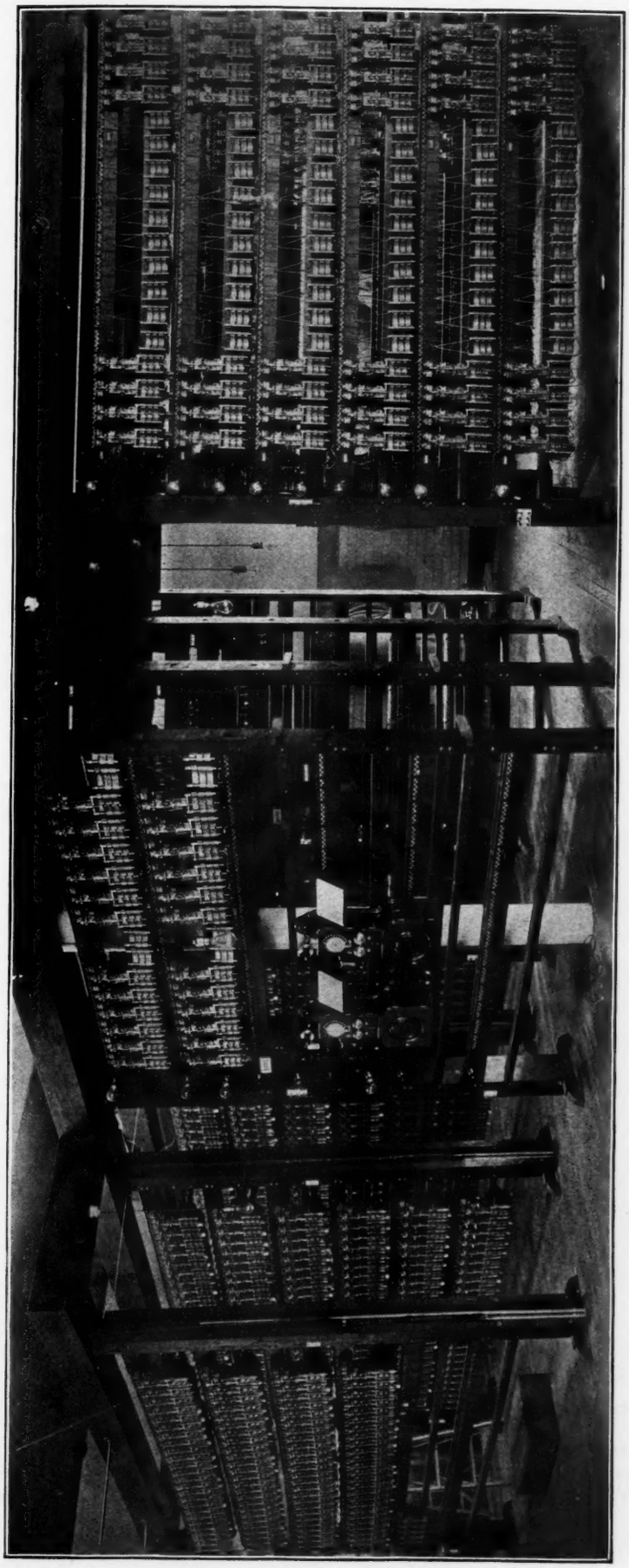
PART OF THE MAIN SWITCHBOARD, INDEPENDENT TELEPHONE EXCHANGE, ROCHESTER, N. Y.



BACK OF THE MAIN SWITCHBOARD, ROCHESTER INDEPENDENT TELEPHONE EXCHANGE.



DETAIL OF LIGHTNING ARRESTER BOARD, ROCHESTER INDEPENDENT EXCHANGE.



The Automatic Telephone Switchboard at Fall River, Massachusetts, Showing First, Second and Connecting Selectors for a Total of 1,000 Lines, with 564 Lines Connected and in Service.

in New York city, was recently opened, and represents the present standard of that company in its large exchanges using the common battery system. This exchange handles 7,000 lines on a full multiple switchboard. The incoming calls are announced to the operators by incandescent lamps placed near the answering jacks, and, as one of the illustrations clearly shows, the construction of the calling and ringing keyboard is most elaborate. At the new building, which was erected by the company to accommodate the exchange, are probably the most ample and perfect provisions for the comfort of employés ever installed in a telephone exchange. The installation in this exchange is so large as to require thirty kilowatts of generating apparatus to supply the talking and ringing current necessary.

The exchange of the Rochester Telephone Company, which is illustrated on another page, represents fairly the highest class of work of the independent companies. This office handles over 4,000 subscribers in Rochester proper and the twenty-six towns in the immediate vicinity which are connected in on the same board. The system adopted is the central energy type of telephone appliances made by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, and the switchboard is of the full multiple type. In this station the power supply is from the electric lighting mains of the city, and most elaborate provisions are made to guard against failure or accident, a full duplicate of all parts of the apparatus being kept constantly in service. Load curves taken on this exchange show that the maximum demand for current for operating the entire plant has not yet exceeded a total of 600 watts, which gives an excellent idea of the superior installation maintained on the system. The switchboard is operated with electrically restored visual signals, while the clearing-out signals consist of incandescent lamps placed in the plug circuit. The monitor's board in this station is a very complete and interesting piece of apparatus, and gives full supervision of all the circuits and operators. The Rochester company operates in all over fifty miles of cable, laid underground, and has one of the finest installations that the independent companies have yet established.

The exchange of the Fall River Telephone Company is of the automatic type, using the new appliances of the Strowger company. It is well shown in the accompanying large illustration, which gives a view of the selecting devices used in performing automatic connection and disconnection between any subscribers on its lines. This exchange had last month a total of 600 subscribers, the switchboard being competent to serve more than twice that number. Connections are made upon it automatically by the operation of a numbered dial on the subscriber's instrument, which is turned in succession to the various numbers making up the call of the desired party. Disconnection is automatically accomplished by hanging up the receiver. In this system the only attention requisite in the switching room is such as is usually given to electrical apparatus, and the personnel of the company is reduced to an absolute minimum. The service has been highly satisfactory at Fall River, and is being extended to other points in New England.

Modern Telephone Apparatus and Equipment.

Illustrated Descriptions of New Telephone Apparatus and Appliances Made by Manufacturers in the United States.

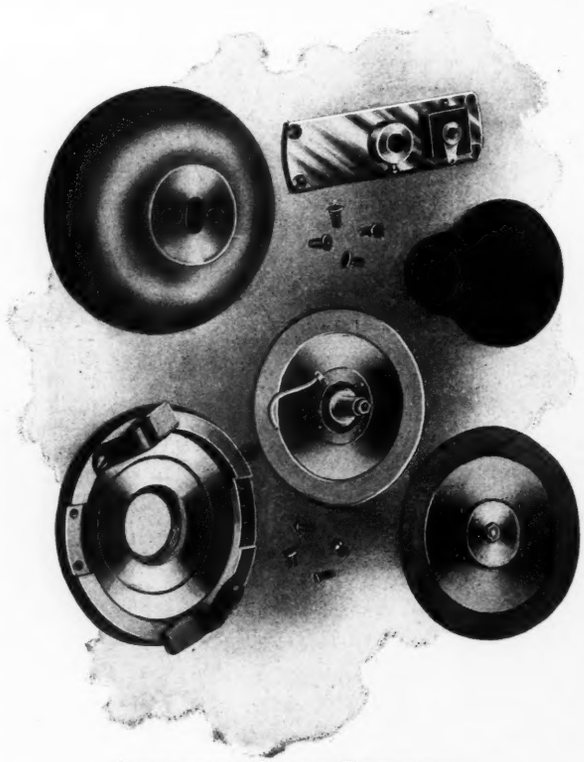
IN NO DEPARTMENT of electrical engineering has advance been more rapid or improvement greater than in the development of telephone apparatus for all purposes. Whether it be the installation of a great central exchange, with several thousand connected subscribers, or an intercommunicating system of a few telephones connecting the departments of a factory or a business office, the same improvement in material and apparatus is noticeable. While many new designs of great originality and value have lately appeared, in the descriptions following are noted only a few of the more excellent appliances of this character, the space at disposal not permitting more than a casual reference to many appliances of great value.

It will be noticed, in comparing these designs with others of an older date, that the general tendency has been to improve telephone apparatus along mechanical lines, and without reference to any great saving in its first cost to produce apparatus of high efficiency and great reliability. In this the manufacturers have succeeded admirably, and the appliances described represent the culmination of a long period of experimental practice in which was secured the data for the noticeable improvements that have been made. Of course, it would be ridiculous to say that finality or anything approaching it has been reached in the field of telephone manufacture. But a certain standardization of apparatus and parts is beginning to be noticeable, and this may generally be regarded as an indication that manufacture has reached a stable and satisfactory period. The appliances shown reflect a high measure of credit upon its makers.

THE APPARATUS illustrated on this and the following pages is representative of standard practice in this country. Much of it is entirely new; some part of it represents simply improvements on existing apparatus, while a certain portion is only representative of the standardization of well-known types in conformity with the requirements of present demands.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY.

Among the novelties lately produced by this company is the transmitter, whose parts are illustrated in the accompanying engraving. This transmitter was designed to overcome the difficulties which have frequently been encountered in similar apparatus due to the packing of the granular carbon material and to indistinct articulation of loud tones. The transmitter is of the reverse solid-back type. The cell which contains the granular carbon and electrodes is formed in and constitutes a part of the diaphragm, as shown in the illustration. The electrode corresponding to the front electrode in the well-known "solid-back" transmitter is rigidly held, so that not only is the piston effect obtained, but the entire cell vibrates with the diaphragm, thus keeping the granules well shaken up. This not only prevents packing but is stated to produce a wide variation in resistance giving very powerful transmission. The granules of carbon are made by a special process securing highly polished faces without the necessity of filling the pores of the carbon. The carbon is the result of a great number of experiments and tests, as it is considered by the manufacturers to be one of the most vital points about a transmitter to get carbon of uniform size and resistance and a material that will retain these qualities indefinitely. The working parts are sealed by riveting a retaining-ring over a thin mica disc which forms an auxiliary diaphragm. This construction prevents the parts being tampered with and at the same time renders the cells practically moisture-proof. The diaphragm is formed of hard drawn aluminum, surrounded by a soft rubber gasket held in tension by two steel springs, a construction which is said to prevent the diaphragm responding to noises in the room while making it extremely sensitive to speech into the transmitter. The front of the transmitter is turned up from a solid brass casting and all of the mechanical parts are very rigid. The transmitter is made in two styles, one intended for local battery and the other for common battery service, these two imposing slightly different conditions upon the transmitter design. The instruments represent the result of much study and experiment.



PARTS OF THE KELLOGG TRANSMITTER.

The Kellogg company has also lately greatly improved and perfected its design of switchboards, both for distributed and central energy systems, and has also improved in considerable detail the form of bipolar receiver used with its instruments in order to secure the

maximum of power with the minimum of weight and great permanence of adjustment.

THE UNION SWITCHBOARD COMPANY.

The manufactures of the Union Switchboard Company consist of switchboards, one of which, installed in the independent exchange at Erie, Pa., is shown in the accompanying illustration. The system is extremely novel in its method of operation. Subscribers' calling signals are received on a drop rack of large size situated on one side of the room directly in front of and in plain view of all the operators. Immediately before the operators are only the multiple jacks, with the usual regular operator's keys and equipment. When a subscriber signals the exchange his drop falls in the usual manner on the drop rack, exhibiting his number in black characters. At the same time a pilot lamp at the position of his operator is lighted. She plugs in at the corresponding number to ascertain his wants, when the number on the large drop rack changes from black characters to red, thus showing the monitor operator that the call is receiving attention. When the desired connection is given that number also shows red on the drop rack, these red numbers thus constituting a visual busy signal, and the operators being informed by a glance at the drop rack of the condition of lines. The auxiliary board, shown at the right of the illustration, is for the use of monitor operators, who take care of calls that can not be immediately answered by the regular operators, thus effectually doing away with delays due to this cause. It is claimed by the makers that the extreme simplicity of the circuits employed, the absence of resistances, impedances or repeating coils, condensers or similar devices greatly improves the efficiency of the system and reduces liability of switchboard trouble to a minimum. The Union Switchboard Company has its offices and factory at Erie, Pa.

THE EXCHANGE AT ERIE, PENNSYLVANIA, INSTALLED BY THE UNION SWITCHBOARD COMPANY.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY.

This company, whose headquarters are in Chicago, was one of the pioneer manufacturers in the independent telephone field, having constructed and equipped a large number of exchanges in the earlier days of the industry. The switchboard shown in the accompanying illustration is that installed by this company at Williamsport, Pa. This switchboard is of the central energy type, with automatic restoring line signals and double supervisory lamp signals. The line signals supplied by the company may be either of the visual type or of the incandescent lamp type, but in either case the signal is restored by the insertion of the answering plug. The visual signals are placed in the upper part of the sections just opposite the eyes

WESTERN TELEPHONE CONSTRUCTION COMPANY'S SWITCHBOARD, AT WILLIAMSPORT, PENNSYLVANIA.

of the operator, so that any call is immediately noticed. The space for the multiple jacks is just below these signals, these multiple jacks being repeated every six panels. The distance which the operator must reach is diminished to the smallest practicable extent on these boards, the jacks being constructed with very short spaces between centres and only occupying seven-sixteenths of an inch horizontally and vertically. All the parts of the board are held together by a structural steel frame and are not dependent upon cabinet work for support.

All of the visual signals are provided with night-alarm contacts, the signals being usually mounted in strips of twenty upon iron racks. These racks are carefully insulated from the iron frame of the switchboard to prevent any opportunity for trouble from grounding in the lamp-signal board. The lamps are placed immediately below the corresponding answering jacks in rows of ten each. The multiple jacks installed upon these boards contain features which are claimed to be of unique excellence. Any part of the jack may be easily and quickly replaced at any time. The ferrules or sleeves may be unscrewed and removed from the front and new ones inserted. This enables replacement to be made of the parts exposed to the severest wear. All the springs of the jacks are made of German silver of large dimensions. The ringing and listening keys are built up on an iron frame with hard rubber insulation and German silver springs having platinum contacts. The relays used on the company's new board are of the ironclad pattern, and it is claimed will work with satisfaction over very long lines. The company's central energy transmitter is claimed by the maker to work well on long lines and consume very little current, the average consumption for an exchange of 1,000 subscribers being three amperes and the maximum consumption about six amperes.

The company is manufacturing a distributing rack having an iron frame, one side being adapted to hold the switchboard terminal strips and the other carries the slate-backed lightning arresters and head coils. A large number of these improved multiple boards have recently been installed, that illustrated, which has been constructed at Williamsport, Pa., being typical of several lately put in service.

THE GLOBE AUTOMATIC TELEPHONE COMPANY.

The Globe Automatic Telephone Company, of Chicago, manufactures automatic telephone apparatus for both central exchange and intercommunicating purposes. The claim for this apparatus, made by the maker, is extreme simplicity. The instruments are made to operate by a modification of the step-by-step method, each telephone being equipped with a calling keyboard consisting of three keys, one for the hundreds, one for tens and one for the units in systems intended to operate up to 999 telephones. In calling, the keys are moved to the desired number in each class and the called subscriber is then rung up in the ordinary way. Should his line be busy a busy signal is given, and no interference is possible. When the lines are not in use they are consequently always accessible, and when in use are absolutely private. The apparatus installed at the central exchange is claimed to be of a very strong and substantial construction.

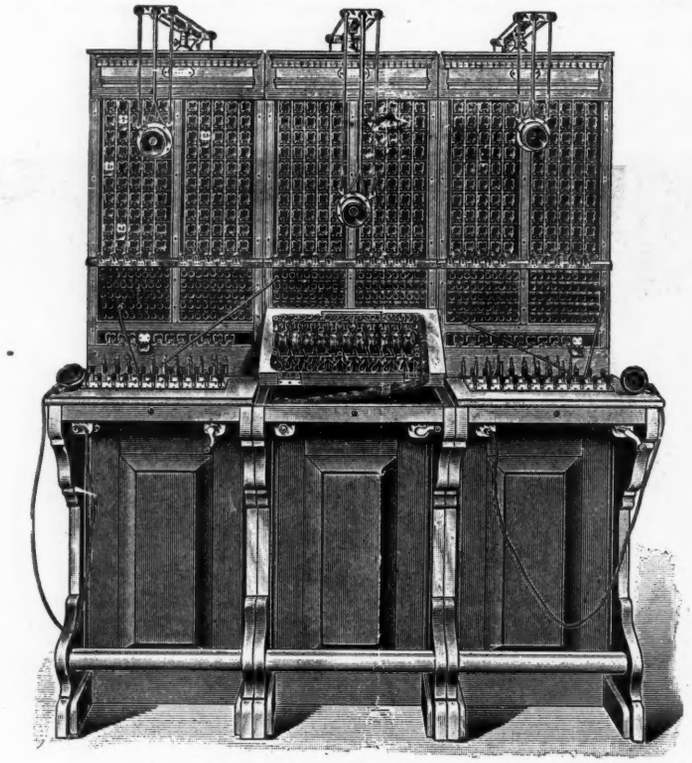


FIG. 1.—STANDARD TELEPHONES AND ELECTRIC COMPANY'S AUTOMATIC DROP-RESTORING SWITCHBOARD.

FIG. 2.—STANDARD TELEPHONE AND ELECTRIC COMPANY'S PORTABLE SET.

THE STANDARD TELEPHONE AND ELECTRIC COMPANY.

The novelties which this company is offering this season consist of the switchboard and the portable set shown in the accompanying illustrations.

The switchboard is of the automatic drop-restoring type, having improved circuit-changing keys and tubular clearing-out drops. As the illustration clearly shows, the board is made in sections of one hundred drops each, the clearing-out drops being mounted below the answering jacks, while the ringing and listening keys are mounted on a shelf on the lower part and are immediately accessible by means of hinges allowing the shelf to be turned up. The cords and cable terminals are of a new and improved design.

The portable set is rather a novel arrangement, the standard being of solid mahogany, while the base and top of the instrument are made of brass, fully nickeled. This instrument, like all the other telephone manufactures of this company, is provided with the Mildé transmitter, which has now been in use abroad and in the United States for over ten years and has achieved an enviable reputation. This

instrument is entirely self-contained and has no parts to get out of adjustment. It is claimed by the maker that it is exceedingly economical of battery current.

FIG. 1.—WILLIAMS-ABBOTT COMBINED REMOVABLE SPRING-JACK, DROP AND COIL.

The Standard company has recently constructed a fine new factory at Madison, Wis.

THE WILLIAMS-ABBOTT ELECTRIC COMPANY.

The Williams-Abbott Electric Company, Cleveland, Ohio, manufactures telephone apparatus of all kinds. The illustration on this page shows the combined removable spring-jack, drop and coil employed by it upon its standard metallic circuit switchboard. This instrument, which is the subject of patents by Mr. H. C. Dodge, combines many features of novelty and merit. The shutter is automatically restored upon the insertion of the plug into the jack, while the apparatus is greatly condensed and brought into the small compass necessary for use on modern switchboards of large capacity. The construction and operation of this instrument are easily understood from the illustration. It is adapted for use both on local exchange and toll-line boards, and both line and clear-out drops of tubular form are made non-inductive and of high sensitiveness. The tubular casing of the coil allows the use of coils either of series or bridging type. Inserting the drop in its place on the board and then screwing down two thumb-nuts completes all of the night-bell and line connections and so simplifies the connections of the switchboard as to prevent the possibility of faulty connections. All of the cord circuit connections are insulated with hard rubber. The standard switchboard made by the company is of quarter-sawed oak containing these units, ten pairs of cords with plugs and ten listening, ringing and back-ringing keys and ten clearing-out drops being provided for each operator's position. For large installations a highly developed form of multiple lamp signal transfer system is provided. The cabinets are made up in sizes of twenty-five, fifty and one-hundred-drop capacity. The company's distributing boards are of exceedingly convenient form and comprise also carbon lightning arresters, heavy-current arresters and test-jacks. By means of the latter any line can be tested from the cross-connecting board to the subscriber or to the switchboard without the disconnection of any wires. Lines may be connected to the clips either by soldered joints or screw and washer connections. The clips are plainly numbered on both sides of the distributing board, whereby lines are easily located and the tracing of jumper wires greatly facilitated.

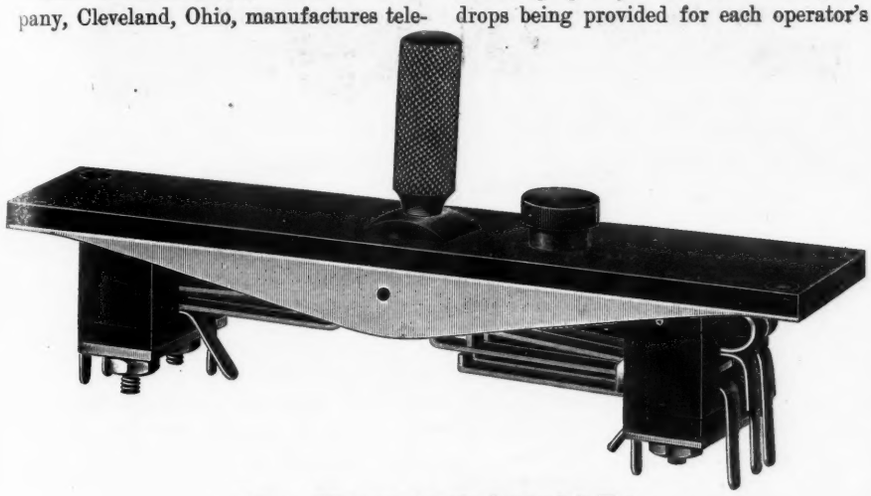
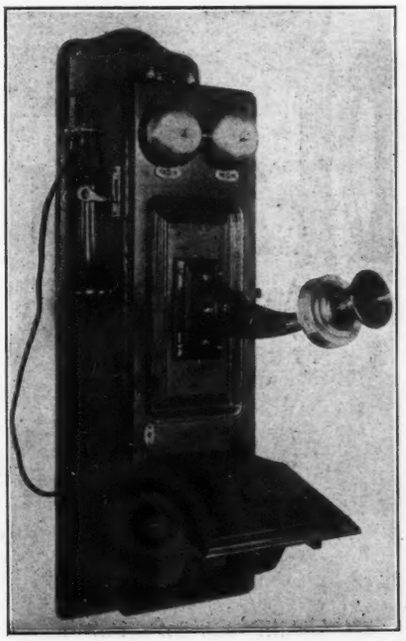
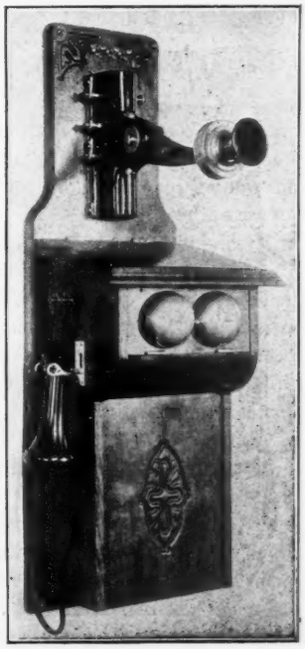


FIG. 2.—WILLIAMS-ABBOTT OPERATOR'S KEY.

THE CONNECTICUT TELEPHONE AND ELECTRIC COMPANY.

The instruments manufactured by this company and here illustrated are of two different and interesting types. The telephone shown in Fig. 1 was designed with the object of making as compact an instrument as possible and of installing all of the necessary parts in a single box structure. The wall box is made in three parts, the upper containing the switch hook, induction coil and ringer; the middle section containing the magneto generator, and the lower section containing the necessary battery for operating the transmitter. This compartment holds two dry cells. By unlocking the front of the instrument the whole of the interior is at





FIGS. 1 AND 2.—CONNECTICUT TELEPHONE AND ELECTRIC COMPANY'S INSTRUMENTS.

once exposed, thus rendering any repairs or changes very convenient. This instrument is made up with a powerful long-distance transmitter, an improved receiver and a new type of magneto ringing generator. It is constructed either for bridging or series lines of any capacity, and, if desired, is furnished with a carbon lightning arrester mounted between the binding-posts on the top of the instrument.

The second type of telephone, illustrated in Fig. 2, is made up on the general lines of central energy apparatus, but is designed to operate on magneto ringing systems. The cabinet is so constructed that the upper lid can be raised and the front may be lowered or opened, while the battery box at the lowest part of the structure is supplied with a door so that the batteries are accessible with very little trouble. The general design of this very neat instrument is well shown in the accompanying illustration. It is intended primarily for use in residences.

THE HOLTZER-CABOT ELECTRIC COMPANY.

The telephone manufactures of the Holtzer-Cabot Electric Company, of Brookline, Mass., comprise numerous varieties of appliances, the illustrations here showing a magneto bell and a new intercommunicating desk set intended for operation in connection with the Ness automatic intercommunicating telephone system. The magneto bell is of the five-magnet type, and is an instrument of high power intended to be used on bridging lines or in other places where a magneto bell capable of ringing through a very high resistance is desirable. The shunt in these ringers is of most ingenious construction and depends upon centrifugal action for its operation. A case containing silver-plated granules is made to rotate with the armature, and these, flying up when the armature turns, open the circuit immediately. These magnetos are made in a number of sizes and wound for ringing through a variety of resistances.

The intercommunicating desk set embodies all of the desirable features of the wall telephone, and is entirely automatic in its operation, the restoring mechanism being located in the base of the instrument, while calling is accomplished by the switch on the top of the base. This automatic system is made in a variety of forms adapted to the various requirements of intercommunicating installations. The smallest size made is a ten-point instrument, which takes care of ten stations or any number less than that. The instruments are made also of sixteen and twenty-point sizes, with capacity for a corresponding number of lines.

THE WESTERN ELECTRICAL SUPPLY COMPANY.

The central energy telephone apparatus handled by the Western Electrical Supply Company, of St. Louis, Mo., is adaptable either to small or large exchanges. In the accompanying illustrations are shown several of the details of this system, which are practically self-explanatory. The iron framework of the visual signal multiple board is of very rigid construction, ensuring great stability and not permitting the situation of the switchboard appliances to depend in any way upon the rigidity of the wooden framework. These switchboards are closed at the back with heavy felt curtains mounted upon substantial rollers, serving to keep out dust from the rear of the board while permitting ready access to all of the parts. The key shelves of each operator's position are hinged separately, the wood used in their construction being of three layers thickness, with the grain crossed, thus eliminating the possibility of warping. The circuit-changers are enclosed and of a dustproof type. The visual signals or lamps are mounted on the upper part of the board, while immediately below them are mounted the multiple jacks, with the answering jacks on the lower panels directly in front of the operator's position. In this system the call to central is accomplished by removing the subscriber's receiver from its hook, causing a visual signal to appear in front of the operator, a pilot lamp to light at her position, and a pilot lamp on the chief operator's desk to light as a supervisory signal. The insertion of the answering plug extinguishes all the lights. When the conversation is finished miniature incandescent lamps on the cord circuit are illuminated, showing that a dis-

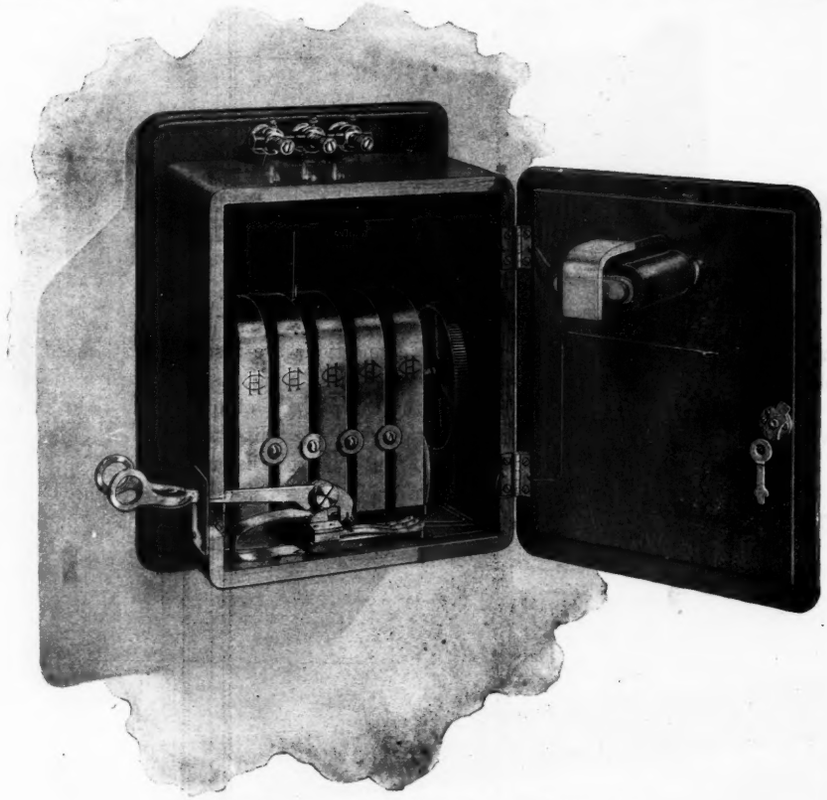


FIG. 1.—HOLTZER-CABOT FIVE-MAGNET GENERATOR.

FIG. 2.—HOLTZER-CABOT INTERCOMMUNICATING DESK SET.

connection is desired. The busy signal is given by an audible click sounding in the operator's head telephone should she attempt to plug in a line that is already in use.

FIG. 1.—IRON FRAMEWORK OF WESTERN ELECTRICAL SUPPLY COMPANY'S SWITCHBOARD.

The Western Electrical Supply Company has already supplied a large number of exchanges with this type of apparatus, which, it is stated, is giving very general satisfaction.

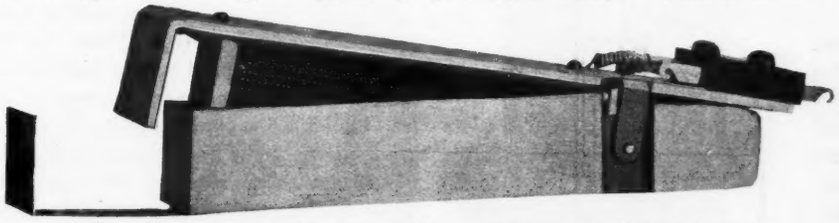


FIG. 2.—VISUAL SIGNAL APPARATUS, WESTERN ELECTRICAL SUPPLY COMPANY.

THE STROWGER AUTOMATIC TELEPHONE SWITCHBOARD COMPANY.

This concern, whose headquarters are in Chicago, manufactures apparatus for the installation of automatic telephone exchanges, of which a considerable number are in successful operation in different parts of the United States. Perhaps the most interesting of these plants is that at Fall River, Mass., which was described at length in the ELECTRICAL REVIEW for November 16, and of whose main switchboard apparatus an illustration appears on page 731 of this issue. The accompanying illustration represents one of the selector switches used on the Fall River and New Bedford, Mass., exchange switchboards. This instrument handles the connections for an exchange up to 9,999 lines capacity, three instruments being requisite to complete a call. The movements of the selector switch are two in number, the rod shown at the front of the apparatus being moved up by a step-by-step mechanism and then rotated so that the three arms carried at its lower part engage with certain of the contacts on the semi-circular banks below. The movement of the switch is governed by the relay magnets on its back frame. The apparatus is very compact, the illustration here shown being about half actual size, and its construction exhibits the result of extraordinary mechanical and electrical ingenuity, while its operation is said to be entirely satisfactory.

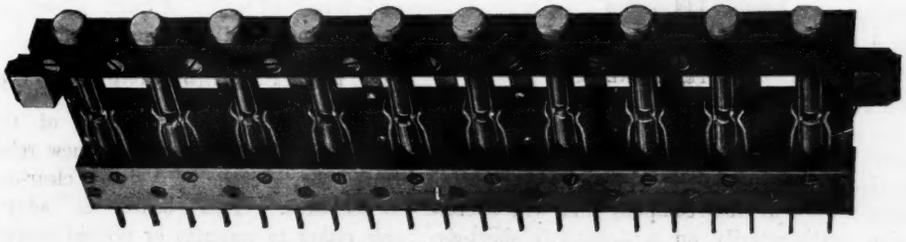
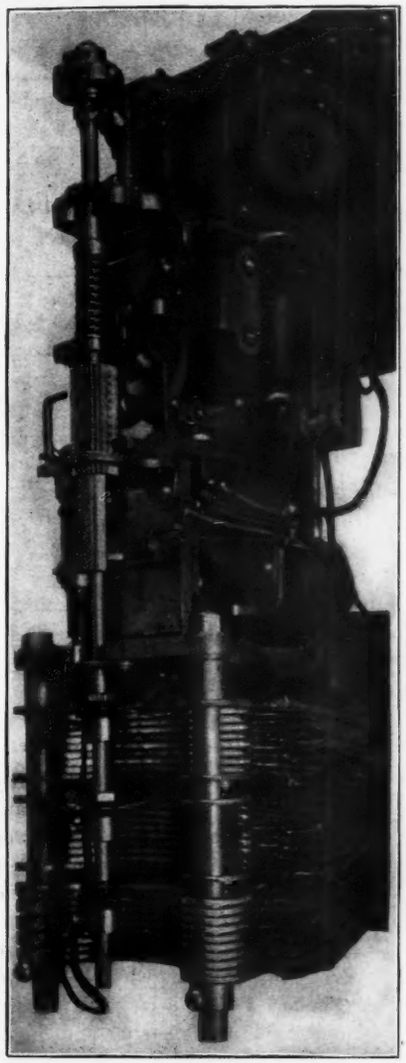


FIG. 3.—LAMP SIGNALS, WESTERN ELECTRICAL SUPPLY COMPANY.



AUTOMATIC SELECTOR TELEPHONE SWITCH, STROWGER SYSTEM.

THE FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY.

The specialty of this company, whose headquarters are in Chicago, at present is bridging telephones, intended for use where twenty or thirty instruments are to be placed on one line. The magneto generators used on these instruments are made in three types, adapted to ring the standard bell through 50,000, 100,000 and 150,000 ohms, respectively. The permanent magnets used in these instruments

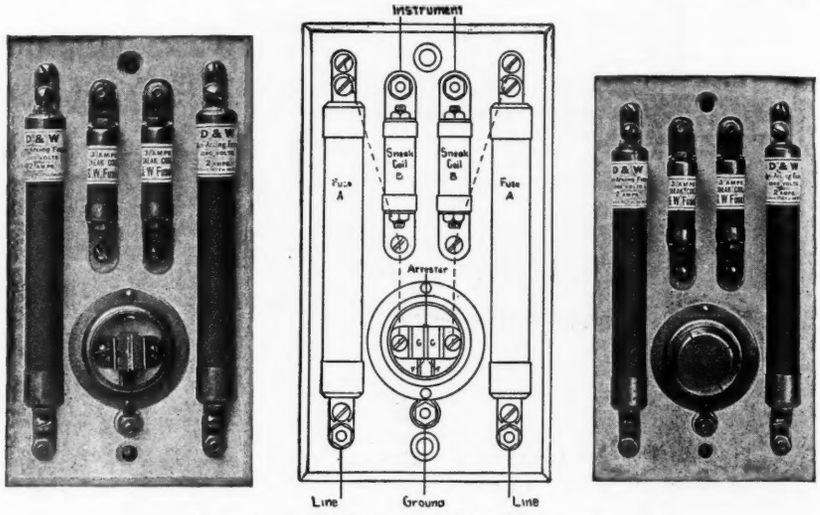
sustain from ten to twelve times their own weight and laminated armature cores are used. The coils of the ringers are wound with very fine wire of from 1,600 to 3,000

FIG. 1.—FARR BRIDGING SET.

ohms resistance, and with sufficiently high inductance to present practically an infinite impedance when bridged across the talking circuit. The transmitters employed on these instruments are of the carbon type, having aluminum diaphragms, and are stated to give excellent results on long lines heavily loaded with telephones. A bipolar type of receiver is used, having magnets made of high-grade Norway steel and wound to a resistance which has been found most satisfactory in practice. The exchange and residence telephones constructed by this company are only eight inches wide by twenty-six inches high and form very compact and neat instruments. Their wooden parts are of quarter-sawed oak, highly polished. The Farr company also manufactures a large list of other telephone supplies and appliances of various types.

THE D. & W. FUSE COMPANY.

In addition to its manufactures of fuse-protecting apparatus for all varieties of electrical circuits, the D. & W. Fuse Company, of Providence, R. I., is an extensive manufacturer of telephone protecting apparatus. The accompanying illustrations show some varieties of this apparatus intended especially to afford protection against lightning and crosses with high-tension lines. This protector embodies a



SOME D. & W. TELEPHONE FUSE PROTECTORS.

lightning arrester for relieving the line of high electrostatic potentials and also of fuses and "sneak coils" intended to prevent damage from heavy currents. The method of connection is shown in the dia-

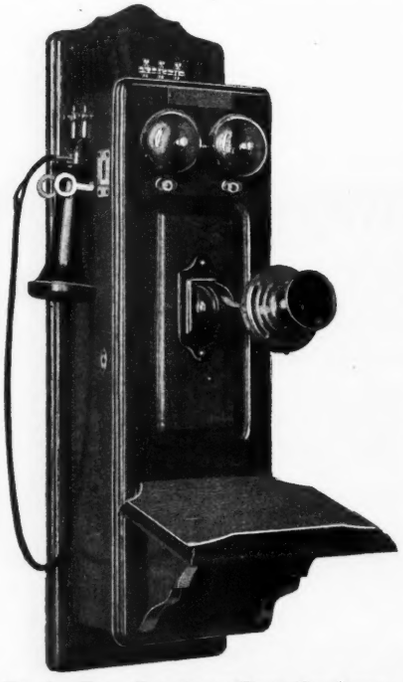


FIG. 2.—FARR RESIDENCE TYPE EXCHANGE TELEPHONE SET.

gram. The fuse is constructed upon the same principle as the well-known high-tension enclosed fuses made for lighting work by this company and will operate satisfactorily on a 3,000-volt short-circuit. The sneak coils are built to operate on currents of from one-tenth to five-tenths ampere, those working at two-tenths ampere being recommended for telephone service. The lightning arrester is of the carbon-plate type, consisting of a carbon block separated from a ground plate by mica or an insulated water-proof film. With the mica an air-gap of 0.008 inch is provided, while with the film only 0.0025 inch separates the carbon from the ground plate. The makers recommend and prefer the film type of arresters, since this apparatus practically keeps the line grounded with regard to electrostatic effects, while at the same time testing clear of grounds for the operating and other currents employed. When the line becomes grounded with a high-tension current the film has the property of automatically grounding it. Since trouble from slight leakage current is more common than absolute crossings the sneak coil is made to operate when such currents are diverted through the instrument, this apparatus being easily renewed and replaced as desired. The sneak coil consists of a very small, close-wound coil made in two parts, which are under tension with reference to one another, these being soldered together by a solder of special composition and having a very low melting point. The whole apparatus is enclosed in a capsule of hardened gelatine and forms a highly efficient protecting fuse against small leakage currents.

THE EUREKA ELECTRIC COMPANY, INC.

Among the recent products of the Eureka Electric Company is a new relay supervisory, electric light signal, clear-out switchboard. This board is adaptable either to magneto or central energy

call system exchanges. The special features embodied in this board are that there are no separate relays for operating line signals, these being indicated to the operator by the lighting of a small incandescent lamp. The relays employed are self-contained, self-restoring and have the lamp signals enclosed in their cores. The board by this means is considerably simplified. In addition to this switchboard apparatus the company makes a complete line of multiple switchboard and other telephonic apparatus of all kinds, and within the last three years is said to have equipped and installed apparatus in more than 2,000 exchanges.

STANLEY & PATTERSON.

The latest improved type of automatic patented intercommunicating apparatus placed on the market by Stanley & Patterson, 93 Liberty street, New York, manufacturers of De Veau telephone apparatus, merits special attention. By use of the De Veau patented automatic switchless telephone apparatus any station may be called by pressing the button, with the receiver either on or off the hook. When you put the receiver back on the hook, the connections are automatically restored. By holding the button down on the first call and pressing any other button, one or more additional parties may be cut in and take part in the conversation, thereby obviating the necessity of repeating the same. This feature is novel with this apparatus, and in itself saves a great deal of time.

The act of pushing in the button all the way calls the station. When the pressure on the button is removed, it comes half way back and cuts in the talking circuit.

The switchless intercommunicating desk telephone is artistically designed and an ornament to any desk. Each instrument is fitted with De Veau solid-back Bell type transmitter and solid bipolar receiver.

Fig. 3 shows the interior of the wall type De Veau patented automatic switchless telephone. The telephone is wired complete to a hinged backboard, so that the line circuits can be connected permanently to the backboard. The interior of the telephone can be examined or the circuits tested without disconnecting any of the wires.

The De Veau solid-back Bell type long-distance transmitter (Fig. 4) is the result of many years' careful study and extensive experiments. The diaphragm is made of aluminum, specially coated to prevent its becoming corroded. This bridge is provided with a bushing or collar, through which the back electrode plunger passes. As shown in illustration, this collar is provided with a screw, by means of which any adjustment of resistance in the carbon electrode desired may be made and, when properly adjusted, firmly fixed by setting of screw, as shown in illustration. The front electrode is attached to the diaphragm by a screw and lock nut. The method by which the electrodes are manufactured is entirely original.

The carbon granules used in De Veau solid-back Bell type transmitters are prepared in the company's own factory. The manufacturers employ a special process and can guarantee its resistance. The front plate of transmitter is made of heavy cast bronze metal, which entirely eliminates the metallic ring so common to transmitter cases when made of spun metal or of a light-weight casting. The mouthpiece is of new type, with perforated guard and vent holes.

Stanley & Patterson also manufacture a full line of De Veau exchange apparatus for central energy, bridging and series work. There are over a hundred different types of telephones illustrated in their new catalogue.

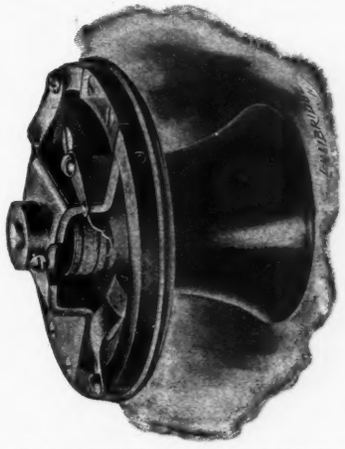


FIG. 4.—INTERIOR VIEW TRANSMITTER.

FIG. 1.—FRONT VIEW OF DE VEAU SWITCHLESS TELEPHONE.

FIG. 2.—SWITCHLESS DESK SET.

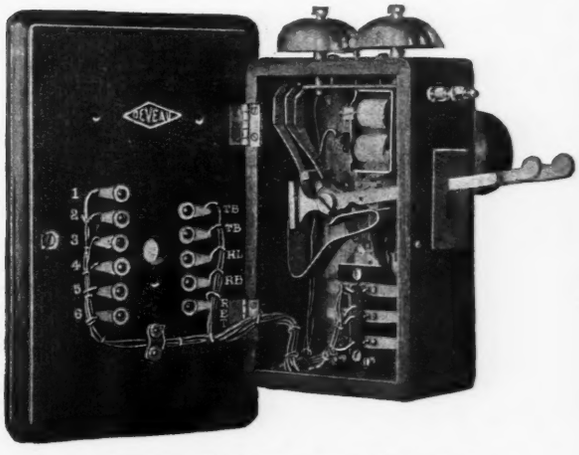


FIG. 3.—INTERIOR VIEW SWITCHLESS TELEPHONE.

American Society of Mechanical Engineers.

At the election of officers of the American Society of Mechanical Engineers, which met recently in New York city, the following were elected: President, Edwin Reynolds, of Milwaukee; vice-presidents, Wilfred Lewis, Philadelphia; M. E. Cooley, Ann Arbor, Mich., and M. P. Higginson, Worcester, Mass.; treasurer, William H. Wiley, New York; secretary, Professor F. R. Hutton, New York.

Correspondence Instruction.

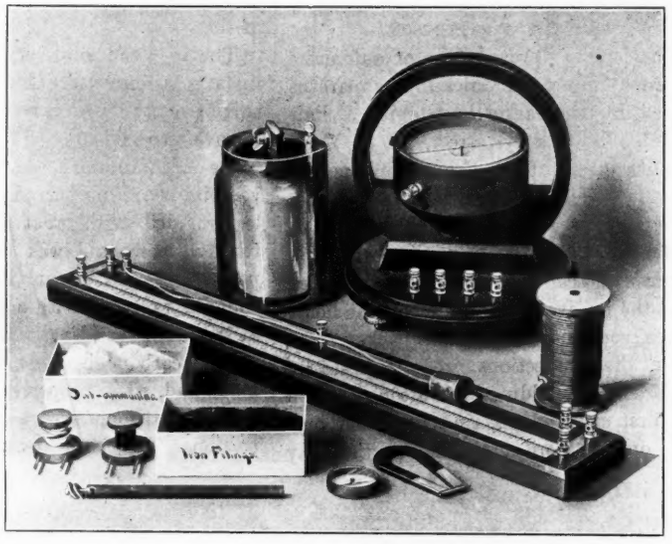
In the last ten years the method of instruction by correspondence has become of vast importance in this country, and at present a very large number of students are enrolled in these courses, those furnished by the International Correspondence Schools, of Scranton, Pa., having enrolled probably the largest number of students to be found in connection with any institution of learning in the world.

A little over ten years ago the editor of the *Colliery Engineer,* an educational magazine published at Scranton, became convinced that a systematic course of instruction in coal mining, adapted to the needs of ambitious men of little education, would be of great advantage in the immediate neighborhood. In October, 1891, such a course was prepared and students shortly began to enroll for it. The success of this course soon led to the preparation of others of mechanical, steam and electrical engineering, and from these beginnings there was rapidly evolved the institution known as the International Correspondence Schools.

The method adopted in this variety of instruction is to send a student pamphlet instruction papers beginning with the fundamental principles of the profession or trade which he is studying. In the electrical course the first papers deal with arithmetic. These are especially prepared for home study and are widely different from the ordinary text-books. After the student has mastered his first instruction paper he is required to answer the questions in an examination paper forming part of the first lesson. His answers are examined and corrected, the errors pointed out, and the student furnished with such instruction as he requires to master any of the difficulties of the lesson. This system of study, examination and correction is followed throughout the entire course until it is completed and a diploma granted. The feature of the system, however, consists in furnishing each student at the outset with a duplicate set of his papers, neatly and durably bound, to be used as a reference library in his work. For example, a man may be a student of the course in dynamo running, and although he may be studying the first papers in arithmetic, the possession of the school's reference library will enable him immediately to solve most of the various technical problems which constantly arise in practical work.

It is stated that the results attained in electrical instruction have been more gratifying than in any other direction. The course has been constantly revised to meet the necessities of the rapidly advancing science, and specialized courses in different branches have been added from time to time. The various courses treat of practically all subjects embraced in electrical work, some of them being summarized below.

The courses of interior wiring, dynamo running and engine and dynamo running are sufficiently described by their titles. Electric lighting is the course intended for those engaged in the operation of electric lighting stations or the installation and maintenance of lines and interior wiring.



Experimental and Testing Outfit Furnished to Students of the Electrical Engineering Courses, International Correspondence Schools.

Electric railways is a course intended for those engaged in the operation and maintenance of electric traction systems. A combination course is also offered in these two subjects.

Advanced electric lighting is a course intended for those who desire a thorough knowledge of both the steam and electrical engineering branches of the work, or for those who wish to qualify to take charge of electric light and power plants and systems. Instruction in these courses includes, in addition to the fundamental subjects, lessons concerning boilers and fittings, combustion, fire draft, boiler management, feed water, steam engines, the indicator, governors, valve gears, compound engines, steam pumps, elevators, steam heating, the elements of electricity and mechanics, dynamos and motors and their operation, dynamo-electric machinery, alternating currents and electric transmission, with optional instruction in drawing and interior wiring.

Advanced electric railways is a course cognate with the above on the subjects covered by its title. A course in electric car running is also offered for the use of motormen, conductors and barn employés who desire a thorough knowledge of the principles of operating electric cars. Engine and dynamo running is another course intended for engineers, firemen and dynamo tenders. The steam-electric course is intended for those who desire thorough instruction in all of the details of steam engineering, electric lighting and railways.

Electrical engineering is the full course intended for superintendents of electric factories, machinists, draftsmen, designers, etc., and all others who wish a thorough practical knowledge of the principles and design of electrical apparatus and its maintenance and installation. This includes a very full course of instruction on the subjects covered by the courses already mentioned and also mechanical engineering. Courses are also offered in telephony and telegraphy.

Students in the electrical and allied courses are provided with the experimental and testing apparatus shown in the illustration. This is furnished in connection with the instruction in elements of electricity and mechanism, and is a valuable and practical aid in putting into practice the principles taught in the course.

The amount of good that has been done by correspondence instruction is hard to overestimate. The enrolment of students in the schools which form the subject of this article has already surpassed 350,000.

New York Electrical Society.

The 219th meeting of the New York Electrical Society will be held Thursday evening, December 19. Professor Dayton C. Miller, of the Case School of Applied Science, Cleveland, Ohio, will lecture on "Polarized Light," with many lantern slides.

POWER TRANSMISSION IN CALIFORNIA.

A DISTANCE OF 215 MILES AT AN EFFICIENCY OF EIGHTY PER CENT.

Dr. F. A. C. Perrine, president of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., recently returned from a visit of inspection to the great power plants equipped by his company in the state of California. When seen on Saturday last by a representative of the ELECTRICAL REVIEW, Dr. Perrine spoke enthusiastically of the work that had been done in the direction of electrical transmission of large powers to long distances in California. He described the two great installations, that of the Bay Counties Power Company and that of the Standard Electric Power Transmission Company, both of which derive their power from mountain streams on the western slope of the mountains forming the divide between California and Nevada, and transmit to the city of San Francisco and to intermediate points, as well as distribute in the neighborhood of the power-houses for mining power and other purposes. Speaking of the recent achievement of the Standard company in transmitting power 215 miles from the Blue Lakes power-house *via* Oakland and around the southern end of San Francisco up to Redwood, Cal., he said that the overall efficiency of this transmission, measured to the receiving step-down transformers at the terminus, was as high at full load as eighty per cent. The power is utilized for lighting, electric railway and general power purposes, and a very considerable portion of it is used also in the operation of shovels and other tools used in placer mining in the gravel drifts near the power-houses. In both of these plants the hydraulic equipment consists of high-head, high-velocity impulse wheels and each plant has a capacity of about 10,000 kilowatts.

Dr. Perrine made some interesting references to his travels in inspecting these plants. In three days he had to travel about 140 miles on buckboards and in buggies, horseback and on foot. Yet in this difficult mountain country heavy hydraulic and electrical apparatus has been successfully installed, the machines being teamed, in some instances, thirty-five miles from the nearest railroad station.

The outlook for the successful operation of these installations is exceedingly good, as coal is expensive and of inferior quality on the Pacific coast. "More than a million pounds," said Dr. Perrine, "of aluminum cable an inch in diameter has been used on these transmission lines and the troubles which were feared by some in connection with brush discharge and air leakage from cable to cable at these high potentials has not been encountered. The operation of the lines so far as completed has been entirely satisfactory."

The plant of the Bay Counties company is already in full operation, its limiting transmission distance being 185 miles. The plant of the Standard company will be started early in 1902, depending somewhat upon belated deliveries of hydraulic apparatus. The electrical installation is already complete.

These lines represent the extreme limit to which electrical power transmission has been extended and reflect both upon their designers and constructors unusual credit. The problem presented was one of extreme and almost monumental difficulty. The solution has been simple and practical, and it is believed that the operation of these installations will add no little to the effective producing power of California industries, and prove the forerunner of numerous other installations of the same general character.

THE HIGH-SPEED ELECTRIC TRACTION EXPERIMENTS IN GERMANY.

BY U. S. CONSUL-GENERAL F. H. MASON.

It is from one of the power stations of the Berlin Electrical Company that the current supply is transmitted at high voltage from Oberschönweide, on the River Spree, above Berlin, across to Marienfelde for the high-speed electrical railway experiments, a preparatory account of which has been given in the ELECTRICAL REVIEW for November 30, 1901. After many months of careful preparation, the actual tests began at the end of September on the stretch of standard-gauge track between Marienfelde and Zossen. They have been from the first carefully guarded from public observation, and no technical account of the difficulties encountered and results obtained will be accessible until the full official report of the engineers in charge of the experiments shall be published.

From entirely trustworthy sources, however, information has been obtained from time to time on the basis of which it can be stated that during the first few days the speed attained did not exceed ninety kilometres (55.9 miles) per hour. This was gradually increased until the record of November 8 shows a pace of 150 kilometres (93.2 miles) per hour, which, according to the best information that can be obtained, is considered the practicable limit of advisable speed with the equipment thus far devised. Above that velocity the increasing danger of derailment and the tremendous strain upon track and rolling stock would, it is believed, outweigh the advantages of higher speed with the machinery now available. It is therefore understood that the experiments are suspended, at least until some radical changes, suggested by this experience, may be made in the construction of motors and other details of the apparatus.

The official report, when it shall appear, will be replete with new and interesting data for electrical scientists. The motors, although in at least one instance "burnt out" by the powerful current, have apparently done all that was expected of them, and the expected difficulty of "getting the current into the car" from a triple overhead wire seems to have been successfully overcome. The other anticipated obstacle, air resistance, proved less serious than was expected. The maximum pressure registered by the instruments placed in front of the cars was 134 kilogrammes per square metre—approximately 16.7 pounds per square foot.

The present results of the experiments, although falling far short of the extreme rates of speed which were somewhat glibly talked about as likely to be attained, demonstrate anew the difficulties and consequent greatly increased expenses which inevitably attach to extreme velocities, but they will form a new and valuable groundwork of demonstrated facts upon which further experiments toward still higher rates of speed can safely be based.

London Underground Railways to Have American Equipment.

The following cable despatch, under date of December 9, comes from London and is believed to be substantially correct:

"It is unofficially, but apparently accurately, announced that Mr. Lyttelton, the arbitrator appointed by the Board of Trade, has decided against the Ganz electric system for the Metropolitan and District railways.

"This statement of Mr. Yerkes's victory was accepted as correct at the Stock Exchange to-day (December 9), with the result that Metropolitan shares advanced 5 and District shares 14."

The physical laboratory at Johns Hopkins University has received a gift of $1,000 for new apparatus from Mrs. L. J. Wood, of Jamaica Plain, Mass.

Chicago Electrical Notes.

(By Our Special Correspondent.)

THE LAST MONTH of the year 1901 finds the electrical industry in Chicago and throughout the West in a most prosperous condition, and there is every reason to believe that 1902 will tell a similar story.

In all of the western states new electric railways are being built, and this has kept engineers, contractors, dealers in railway supplies and manufacturers behind on their orders. Already there are enough western lines projected to make the coming year equally as active in the railway field as the year 1901 has been.

In the telephone field the western developments of the past twelve months have been truly wonderful. Throughout the populous states of Ohio, Indiana, Illinois, Iowa, Michigan and further west, new exchanges have been installed in cities, towns and hamlets, and, in addition to this, residents of farming sections have been connected by rural lines. The farmer and stockman is no longer willing to drive to town to find what price his produce is bringing, but simply walks to his telephone, takes down the receiver and has a talk about the markets with his merchant. These rural lines have drawn heavily on the manufacturers for both instruments and wire, and many of the larger factories have been obliged not only to increase forces but also to put on night shifts. Put it down, therefore, that the telephone manufacturer in the West who does not wear a smile of contentment is suffering from a disordered liver and not an impoverished bank account.

Drop into any of the electrical repair and maintenance shops of Chicago and you will be at once impressed with the magnitude of this branch of the business. These people are rushed with orders and their chief concern is how to do the work on time.

In the motor and dynamo field the same general activity is manifested. Almost every manufacturer of these machines in the West has, during the past twelve months, been obliged to enlarge his factory or work night and day. In some cases both these means have been resorted to in order to fill orders. In several instances quarters were too small, and large, standard factory buildings were erected on modern sites. A number of new companies entirely new in this line of manufacture have entered the field during the coming year. Some prominent factors in the field during the coming year will be too well known to need comment upon this field would be much abridged should I fail to mention the growth of the electric lighting industry. In all of the large cities of the West the lighting companies have made improvements on a large scale, consisting of increases in motive power, generators, general equipment and buildings. But this growth is by no means limited to the large cities. In all of the western states each week has given birth to new electric light corporations which have completed plants or are at present at work on them. The field is not nearly covered as yet, and I hazard nothing in saying that 1902 will be a great light year.

The manufacturers of lamps, both arc and incandescent, throughout the West report a very busy year, and among all of them preparations are being made to meet a growing demand during the coming season. I might say, also, that some of the most meritorious improvements in electric lamps for the year may be credited to western manufacturers. New companies, possessing capital and engineering ability, have been formed for the manufacture of lamps and are now in operation.

The wire industry in the West, embracing rubber-covered magnet and weatherproof wires, is in a very healthy condition. Indeed, it may be said that companies have been well nigh overwhelmed with orders.

It is estimated that during the year 1900 $1,150,000 worth of electric fans were manufactured in the United States. A large per cent of these were the product of western factories. This year it is safe to increase this estimate by several hundred thousand dollars and the West has fully shared in the increase.

In passing, it would be well to mention the manufacture of conduits for underground and interior work. It has been a satisfactory year in this line, and an increase in the output may be safely predicted for 1902.

Western companies engaged in the manufacture of engines—steam, gas, gasoline and oil—used to drive electrical machinery have done "big business." New companies have been organized and new plants constructed, which will be actively engaged in supplying both the domestic and foreign trade during the coming year.

In the manufacture of electrical instruments, batteries—both storage and primary—rheostats, insulators and insulating material, sockets and switches, transformers, electric fixtures, fire and police alarm apparatus, electrical cranes and hoists, carbons and electric bells the West shows both an improvement in the character of its output and a most significant increase.

As I said above, the closing of the year 1901, which, from the standpoint of the electrical manufacturer, has been a brilliant one, gives promise of yet greater accomplishments for 1902.

Chicago, December 7. J. F. C.

THE PRESENT TELEPHONE OUTPUT.

From information received from numerous manufacturing companies it has been possible to make a close approximation to the number of telephones manufactured daily in the United States at present. It is learned that the independent manufacturers are turning out about 2,000 complete sets daily, of which, it is claimed, more than eighty per cent are made in Chicago and its immediate vicinity.

From the instrument statement of the American Telephone and Telegraph Company (Bell) it appears that for eleven months of the year 1901 the rate of output was 2,033 telephones per day. The latter figure, however, represents both transmitters and receivers, and shows the output of telephone sets by this company to its licensees for lease to subscribers to be at the rate of 1,016 sets of instruments per day.

From these figures it is seen that the total telephone output of both classes of manufacturers is in excess of 3,000 complete telephone sets per diem, or over 1,000,000 per year. Taking the average value of these sets and of the switchboard apparatus accompanying them at a fair estimate, it appears that the output of the telephone manufacturing industry in the United States is valued at between $30,000,000 and $35,000,000 per year.

It is believed that these figures are substantially accurate, and from them it is evident that the manufacturing output of the independent makers is about double that of the American Telephone and Telegraph Company's manufacturing department. The independent instruments are sold outright to users and very large numbers of them find use for intercommunicating and private line purposes, whereas all of the output of the Bell telephones is held by the various companies in the Bell interests and are leased to subscribers connected with the exchanges and long-distance lines of that organization, none of them being sold. These figures for telephone equipment do not include line equipment of any kind, nor do they include power plants, generators, cable terminals, storage batteries and other accessory apparatus in use in exchanges. It is probable that the consumption of such material, including poles, wires, fixtures, cables, conduits and power-plant apparatus, is over $25,000,000 a year, making a total consumption and output of apparatus for telephone use in the United States of between $50,000,000 and $60,000,000 every twelve months.

CURRENT ELECTRICAL NEWS

COMMERCIAL NEWS

DOMESTIC AND EXPORT

ELECTRICAL ACTIVITY IN SOUTH AFRICA—It is reported that the docks at Cape Town, South Africa, will be provided with an extensive electric system for lighting and for the operation of hoists, cranes and surface tramways.

CHINESE ELECTRIC TRACTION NEWS—It is said that Shanghai will soon have an electric traction system, the municipal council having decided to advertise for tenders for the construction and operation of tramways. The right to take over the system after a certain period is reserved by the council.

SEATTLE ELECTRICAL ACTIVITY—The Board of Public Works, in Seattle, Wash., has granted permission for the erection of a large number of poles and the stringing of wires to the Sunset Telephone Company and the Seattle Cataract Company. The Independent Telephone Company has also received permission to construct independent conduits.

CAPITAL STOCK INCREASED—At a meeting of the directors of the Chicago Telephone Company, it was voted to increase the capital stock from $9,000,000 to $12,000,000. This stock is to be offered to the stockholders at par in the proportion of one new share to each three of the old. This company furnishes service for Chicago. Mr. John I. Sabin is president.

CONSTRUCTION WORK TO BE PUSHED—The work of building the power plant of the Citizens' Light and Power Company in Rochester, N. Y., is to be pushed as rapidly as possible. Great difficulty has been experienced in securing the necessary steel for the framework, but this is now to be supplied within a short time. This company is capitalized at $2,500,000.

ALASKA MINE TO USE ELECTRIC POWER—It is said that the Treadwell Mine on Douglas Island may be soon operated with electric power. The management is said to be considering the utilization of the water of Sheep Creek for the generation of electricity. It is claimed that enough power can be secured from this river to supply Juneau with electric light and power for years to come.

LARGE CALIFORNIA LIGHTING COMPANY—News comes that a number of eastern capitalists are interested in the formation of a lighting and power combination in San Francisco, Cal. This organization has been organized with a capitalization of $30,000,000. The name of the concern is the California Gas and Electric Corporation. Its plan is to carry on operations in nearly all the cities and towns of California.

TELEPHONE ACTIVITY—Seven Pennsylvania independent telephone companies are to unite. Among them are the People's Lackawanna, Anthracite and the separate Allentown telephone companies, which will combine as the Central Pennsylvania Telephone Company. Mr. S. E. Wayland is to be the president of this company. The new company will control all the lines and instruments of the above named companies besides many small ones.

CALIFORNIA ELECTRIC RAILWAYS—The Oakland & San Jose Railway Company, with a capital stock of $2,500,000, has been formed for the purpose of building an electric line around the bay of San Francisco and from San Francisco to Alameda and Oakland with San Jose as a southern central point. The principal owners are said to be those interested in the railway system of Oakland, Alameda and Berkeley.

PHILIPPINE ELECTRIC RAILWAY—Mr. R. H. Thomson, of Sutton, Neb., is interested in the Lyon Transportation and Improvement Company, the object of which is to build an electric or steam railway from Olangapo on Subig Bay to Orani on Manila Bay, a distance of twenty-five miles. It is said that the region through which it is intended to run the railway is a fertile valley and possesses excellent shipping facilities at both ends.

KNOXVILLE TRACTION COMPANY CHANGES HANDS—The controlling interest in the stock of the Knoxville Traction Company, of Knoxville, Tenn., which was held by Mr. Frank S. Hambleton and others, has been transferred to the Railways and Light Company of America. By this change Messrs. F. S. Hambleton, Bear and Steel have retired from the directory, and Messrs. R. Lancaster Williams, F. C. Todd and A. H. Rutherford have been elected to succeed them.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE BROOKLYN BRIDGE—Chief Engineer Martin has issued his report on the proposed improvements to the Manhattan terminal of the Brooklyn Bridge. Changes, extensions and improvements on the structure at an expense of $3,000,000 are recommended. Part of the plan is for the construction of an elevated railway along Centre and Spring streets to the terminus of Bridge No. 2, and that a branch of this line connect with Bridge No. 3.

ELECTRIC RAILWAY NEWS—It is said that the Everett-Moore and the Mandelbaum-Pomeroy syndicates have reached an agreement by which the Everett-Moore people are to continue the extension of their system in the northern part of Ohio as far south as Findlay, while the Mandelbaum-Pomeroy interests are to confine their operations to the southern part of the state. They have also reached an agreement for a through line from the river to the lake by affecting a combination of traffic.

LIGHTING COMPANIES COMBINE—Articles of merger and consolidation of the Wilmington Coal Gas Company with the Universal Conduit, Light, Heat and Power Company have been filed at Dover, Del. The capital stock of the new corporation is $1,500,000. It is to be known as the Wilmington Gas and Electric Company. Mr. John Dobson, of Philadelphia, and Mr. Edmund Mitchell, Jr., who was a director of the Universal Conduit, Light, Heat and Power Company, are among the directors of the new company.

TELEPHONE COMBINATION—Representatives of six of the large companies of northern Ohio have met and formed a telephone organization. This organization is known as the Geauga County Telephone Association. It comprises the following companies: The Chardon Telephone Company, the Chagrin Falls Telephone Company, the Stafford Telephone Company, the Bainbridge Telephone Company and the Burton Telephone Company. Mr. Charles T. Post was elected president of the organization and Mr. H. C. Tuttle secretary.

NEW BROOKLYN TUNNEL—Ground has been broken at Atlantic and Bedford avenues for a tunnel in that thoroughfare. The sinking of the tracks of the Long Island Railroad beginning at Flatbush avenue and extending as far as Nostrand avenue along Atlantic avenue is provided for in the plans. The tracks will again be put underground at Ralph avenue. The motive power of the entire line to Jamaica is to be changed from steam to electricity and the running time greatly reduced.

NEW YORK ELECTRIC RAILWAY CHANGES HANDS—The property and franchises of the People's Traction Company, of New York city, have been leased by the Interurban Street Railway Company. The lease of the franchises is signed by W. A. Boland, president, and Fred C. Cocheu, secretary of the People's Traction Company, and Andrew A. Halsey, president, and William J. Studwell, secretary, of the Interurban Street Railway Company. The capitalization of the Interurban Street Railway Company is given as $2,500,000.

SOUTHERN POWER PLANT ACTIVITY—Dr. Bertrand, of Hattiesburg, Miss., has been engaged making investigations, securing locations, rights of ways for canals, lines, etc., for the purpose of erecting a power plant for generating electricity. He has submitted results of his investigations, together with maps, etc., to the Easton Power Company, and it is said that his reports have been examined and adopted without change. It is also stated that the chief engineer of the company will soon begin the installation of a plant.

LARGE INCREASE OF CAPITAL STOCK—The stockholders of the Philadelphia Traction Company have met and concluded one of the largest deals in electric railways. All but one traction line in Allegheny County, the West End Company, will come under the control of the Philadelphia Traction Company. At their meeting an increase of the capital stock from $21,000,000 to $36,000,000, and an authorized bond issue from $6,500,000 to $22,000,000 was voted by the stockholders. The Philadelphia company will take possession on January 1.

NEW HAMPSHIRE RAILWAY ACTIVITY—Mr. Wallace D. Lovell, of Newton, Mass., has transferred his electric railway system to the New Hampshire Traction Company, which is composed of New York and Boston capitalists. The following railroads are affected by this transfer: The Exeter, Hampton & Amesbury Railroad and its leased lines, the Dover, Summersworth & Rochester, the Haverhill, Plaistow & Newton, the Seabrook & Hampton Beach, the Amesbury & Hampton, the Haverhill & Plaistow, and the Portsmouth & Exeter railroads.

RAILWAYS TO USE ELECTRICITY—News comes that the experiments which have been carried on by the Great Northern and Northern Pacific railways with electric power have been so successful that these roads will employ it much more extensively in the future. The large machine shops of the Great Northern Railway are to be equipped with electric power. The power for these factories is generated by means of steam engines in some places, but where it is possible to secure it water power is employed. The Northern Pacific Railway also is employing electricity in a number of its shops.

NEW AUTOMATIC TELEPHONE COMPANY—The first papers for the incorporation of the Automatic Electric Company, with a capital of $2,000,000, have been sent to Springfield, Ill. This company, it is announced, has secured manufacturing rights for the United States and the plant of the Strowger Automatic Telephone Exchange. The incorporators are Edwin W. Gearhart, James C. Law, Albert G. Wheeler, Jr., Thomas H. Watkins, Scranton, Pa.; Charles B. Eddy, Alamogordo, N. M., and J. B. Russell & Company, bankers, of New York and Chicago. The new Automatic Electric Company will begin business with an order from the Illinois Telephone and Telegraph Company for a switchboard and its appliances and devices for 25,000 telephones. This company is preparing to compete with the Chicago Telephone Company. It will introduce the Strowger instrument, which permits secrecy in conversation over the telephone. A guarantee will be given to each patron that the cost a year shall not exceed $85 for business and $50 for residence instruments. The automatic switchboard has been installed and used for several years at Augusta, Ga.; Princeton, N. J.; Geneva, Ithaca and Perry, N. Y.; Albert Lea, Minn.; Trinidad, N. M.; New Bedford and Fall River, Mass.

TELEPHONE AND TELEGRAPH

HOLDENVILLE, I. T.—It is reported that the telephone exchange in Holdenville will soon be completed.

WHEELING, W. VA.—It is rumored that the National and Belmont Telephone companies will soon combine.

DUNCAN, I. T.—A line from Duncan to McKnight has been built by the Chickasaw Telephone Company.

NORWAY, ME.—The line of the Eastern Telephone Company will soon be extended from Norway to Harrison.

LA CROSSE, WIS.—The work of constructing a telephone line between La Crosse and Eau Claire has been begun.

NEWPORT, N. H.—The telephone line which extends from Newport to Mill Village will be extended to Cherry Valley.

ATLANTIC, MICH.—A line between Atlantic and Red Ridge is to be constructed by the Michigan Telephone Company.

ZANESVILLE, OHIO—The Zanesville Telephone and Telegraph Company has connected part of its subscribers.

SANTA FE, N. M.—The capital stock of the Grant County Telephone Company has been increased from $10,000 to $30,000.

OAKLAND, NEB.—A new line which extends northwest from Oakland has been completed by the Nebraska Telephone Company.

GENEVA, N. Y.—The system of the Bell Telephone Company is to be reconstructed because of the great increase in business.

STANTON, NEB.—The work on the telephone exchange has been begun, and it is expected that it will be completed within a short time.

DULUTH, MINN.—The work of extending its lines to the Grand Marias mine is soon to be begun by the Duluth Telephone Company.

BUCYRUS, OHIO—The Central Union Telephone Company has begun its new construction work. The entire system is to be overhauled.

LOCKPORT, N. Y.—The cross country line of the Home Telephone Company from Lockport to Tonawanda has been nearly completed.

TRENTON, N. J.—The plant and franchise of the Home Telephone Company have been sold at auction for $20,000 under foreclosure.

ANDERSON, TEX.—The telephone line of Mr. H. R. Jones, which extends from Roon Prairie to Anderson, has been sold to Mr. T. J. McCune.

PORTLAND, TENN.—The Cumberland Telephone Company is setting poles and making good progress in the installation of a telephone system.

ELIZABETHTOWN, N. Y.—The Lewis & Elizabeth Telephone Association has completed the setting of the poles from Reber to Elizabethtown.

NEW DECATUR, ALA.—A line to connect the Decaturs with Sheffield and other towns is being constructed by the Long-Distance Telephone Company.

COLUMBUS, OHIO—A telephone line of aluminum of seven strands is being built by the Bell Telephone Company between Columbus and Massillon.

BIRMINGHAM, ALA.—The capital stock of the Georgia & Alabama Long-Distance Telephone Company has been increased from $10,000 to $30,000.

NEW MARKET, MINN.—The work of extending the line of the Scott County Telephone Company from Credit River Station to New Market has been finished.

SHENANDOAH, PA.—Additional cables are being strung by the Schuylkill Telephone Company and a new switchboard has been placed in the central office.

CHEYENNE, WYO.—The Rocky Mountain Bell Telephone Company has completed its Cheyenne-Douglass telephone line, and the line is now open for business.

CARNEGIE, PA.—The exchange of the Pittsburgh & Allegheny Telephone Company has been completed and is now connected with the main exchange in Pittsburgh.

KENYON, MINN.—The poles and material for a farmers' telephone line between Kenyon and Aspelund have arrived and the construction work will soon be started.

RICHMOND, VA.—The Newport News & Richmond Telephone and Telegraph Company has been absorbed by the Chesapeake Telephone and Telegraph Company.

HEARNE, TEX.—A switchboard has just been installed in the office of the Southwestern Telegraph and Telephone Company by District Superintendent F. M. Rounds.

POMFRET, CT.—Three new telephone exchanges are to be opened on January 1 by the Southern New England Telephone Company in Pomfret, Putnam and Enfield.

SAN ANTONIO, TEX.—An amendment to its charter extending its field of operation to a number of counties of the state has been filed by the Commercial Telephone Company.

DALEVILLE, IND.—Mr. Benjamin, who owns the telephone system in Middletown, has a force of men engaged in putting up poles for the purpose of extending the line to Daleville.

SARATOGA, N. Y.—A new switchboard has been installed in the central office of the Hudson River Telephone Company, which was made necessary by the large increase of business.

WEST SUMNER, ME.—A large amount of construction work has been done by the Oxford County Telephone and Telegraph Company. A line from West Paris to Turner is nearly completed.

SALINA, KAN.—The Sylvan Grove exchange and toll lines have been purchased by the Salina Independent Telephone Company. A toll line is to be constructed from Waldo to Plainville.

JENNINGS, LA.—The new exchange of the Cumberland Telephone Company has been completed. The running of lines to the neighboring towns in the spring is contemplated by the company.

SUMTER, S. C.—The long-distance lines of the Southern Telephone Company will soon connect Sumter with the outside world. A line from Columbia is now being constructed which will soon reach Sumter.

BLOOMINGTON, ILL.—The Central Union Telephone Company is making improvements along its lines. The wires are to be placed in underground conduits and a new switchboard is to be installed.

JOHNSTOWN, PA.—The work of building the Bell Telephone Company's line, which is to connect the long-distance trunk line through Somerset County with the lines of the Listie Coal Company, has begun.

SALT LAKE CITY, UTAH—A right of way along the Oregon Short Line tracks for its wires from Salt Lake City to Cannon, has been accorded to the Postal Telegraph Company through the judgment of Judge Morse.

AUGUSTA, ME.—Mr. Thomas Leigh has applied to the mayor for permission for the Dirigo Telephone Company to lay its poles and wires in that city for the purpose of connecting its northern and southern trunk lines.

BUFFALO, N. Y.—The Bell Telephone Company is to break ground within a short time for a new branch exchange. The object is to relieve the large business of the Bryant exchange which has increased with great rapidity.

DONALDSVILLE, LA.—An ordinance granting a ten-year privilege to the American Telephone Company has been passed by the town council. By the provisions of the ordinance the construction work must be begun within six months.

SHELLROCK, IOWA—Mr. Eckles, who has been working in the interest of a local telephone system, has secured the necessary number of patrons and the material has been ordered. As soon as the material arrives the construction work will be started.

NASHVILLE, ILL.—The Southern Union Telephone Company, which now operates exchanges and toll lines in Washington and Clinton counties, has made preparations to extend its lines. It is expected that the first extension will be made from Venedy Station to Coulterville.

MIDDLETOWN, N. Y.—The directors of the Orange County Telephone Company, together with some of the stockholders, have held a special meeting and decided to expend from $10,000 to $15,000 in improving the present system. Orders have been placed for a large amount of new material.

WYOMING, IOWA.—Mr. H. F. Camp has been in town looking after the interests of the Jones County Telephone Company, a concern which was recently incorporated with a capital stock of $50,000, and has its headquarters at Anamosa. Mr. Camp is the treasurer of the company.

STREATOR, ILL.—At a meeting of the officers and stockholders of the Independent Telephone Company it was voted to increase the capital stock to $100,000. The additional funds will be employed in extending and improving the service and it is expected that the lines will be extended during the coming summer.

ROCHESTER, N. Y.—It is announced that the Rochester Telephone Company has increased its capital stock $200,000 and is making extensive additions and improvements to its plant. A large order for wires and cables has been placed with the Standard Underground and Cable Company to be shipped at the earliest day possible.

BIRMINGHAM, ALA.—The general manager of the People's Home Telephone Company, Mr. S. B. Claypool, states that new instruments will be provided for the patrons of the company within a short time and the exchange equipped with an improved switchboard. These changes are made for the purpose of bringing about a quicker service.

OBITUARY NOTICE

PROFESSOR MAX ESCHENHAGEN died recently at the age of forty-three years. Since its establishment in 1899 he was in charge of the Royal Prussian Magnetic Observatory. He took a very active part in the planning of the magnetic work of the German Antarctic expedition, and in arranging the international work to be carried out simultaneously over the entire globe during the period of the expedition. He has made numerous contributions to terrestrial magnetism and shown great skill in the improvement of magnetic instruments and in the designing of new ones. The light, convenient, portable magnetographs of his design are to be extensively used in the international work.

ELECTRIC RAILWAYS

CHESHIRE, CT.—The work of constructing a trolley line from Mt. Carmel to Cheshire has been begun.

WILMINGTON, DEL.—Work will soon be begun in extending the Brandywine Springs road to Unionville.

WORCESTER, MASS.—The construction of an electric railway between Worcester and Lowell is being agitated.

YORK, PA.—The York & Dover Electric Railway has now been completed and cars have passed over the line.

MUSCATINE, IOWA—The construction of an electric railway between Muscatine and Davenport is being agitated.

PROVIDENCE, R. I.—The pile foundations for the new power station of the electric railway company are now being built.

BROCKTON, MASS.—The extension of the electric railway between Easton and Mansfield to Brockton is being discussed.

SHEBOYGAN, WIS.—The work of constructing the new electric line between Sheboygan and Elkhart Lake has been begun.

LONG BEACH, CAL.—The construction work will soon be begun by the Los Angeles & Pacific Electric Railway Company.

JASPER, N. Y.—Ex-Sheriff L. D. Whiting is interested in the building of an electric railway from Canisteo to Woodhull.

ABERDEEN, WASH.—About $50,000 has been subscribed for the building of an electric railway between Aberdeen and Hohoquhan.

CANTON, OHIO—The Canton-Massillon Electric Railway property has been purchased by the Elkins-Widener Syndicate for about $1,200,000.

FITCHBURG, MASS.—The directors of the Fitchburg & Ashby Street Railway Company have purchased water privileges, land and buildings in Ashburnham.

CAMDEN, N. J.—The line of the Camden & Trenton Trolley Company, which is being built between Camden and Trenton, is nearly completed.

ERIE, PA.—The trolley between Erie and North Erie has now been completed by the contractors, Messrs. Smethurst and Allen, of Philadelphia.

NEW HARTFORD, N. Y.—It is expected that the Clinton branch of the trolley from New Hartford will soon be in operation, the construction work being nearly completed.

DAYTON, OHIO—The People's Railway Company has received permission from the city council to make extensions to its lines in different parts of the city.

COLUMBUS, OHIO—A certificate of increase of capital stock from $1,000,000 to $1,500,000 has been filed by the Columbus, Buckeye Lake & Newark Traction Company.

PRINCETON, N. J.—The borough council has granted the application of the T. L. Johnson Trolley Syndicate for entrance into Princeton through Witherspoon street.

LOUISVILLE, KY.—It is said that the general council will be asked to grant a franchise to a new company for an electric railway over streets not occupied.

ALHAMBRA, CAL.—The work of grading for the Alhambra & San Gabriel extension of the electric road is expected to begin shortly.

BROOKINGS, S. D.—The Commercial Club, of Brookings, is attempting to have the proposed electric railroad between Sioux Falls and Madison extended to Brookings.

NEWPORT, KY.—Colonel Berry and Mayor Nelson, of Newport, are interested in the building of a trolley road from Newport to Alexandria.

COLUMBUS, OHIO—The Columbus, Marion, Tiffin & Toledo Electric Railway Company has been organized. Mr. C. W. Stoltz, of Marion, is the president of the company.

LONDON, OHIO—The machinery for a second power-house to be located at or near London has been ordered by the Columbus, London & Springfield Interurban Railway.

HERKIMER, N. Y.—The survey for the Herkimer, Mohawk & Frankfort Electric Railway line for the purpose of establishing double tracks has been begun by a corps of engineers.

TRAER, IOWA—It is said that the company which was recently organized at Oskaloosa for the purpose of building a line from Oskaloosa to Tama will extend the line to Traer and on to Waterloo.

FINDLAY, OHIO—The Western Ohio Railway Company is to build overhead crossings over the steam railways and principal highways between Findlay and Lima, in order to obtain high speed.

DANBURY, CT.—It is expected that the Interstate trolley between Danbury, Ct., and Goldensbridge, N. Y., will be completed about February 15. This railway is about seventeen miles in length.

PARIS, KY.—The surveying for the Paris, Millersburg & Lexington Electric Railway has been begun. It is expected that the work of actual construction will commence some time in February, 1902.

ELWOOD, IND.—The work of grading the electric line to be built between Elwood and Atlanta has been begun by the Central Traction Company. Mr. C. G. Kirkpatrick, of Anderson, has the contract.

KITTANNING, PA.—Mr. Charles Dunbar, of Allegheny, Pa., has been elected president of the Kittanning & Cowanshannock Valley Street Railway Company, which was recently organized with a capital of $75,000.

LEECHBURG, PA.—Mr. Richard D. Scandrett has been elected president of the trolley company which is to build an electric railway between Tarentum and Leechburg. The capital stock of this company is $85,000.

TRAFFORD PARK, PA.—The new town which the Westinghouse company is building at Trafford Park is to be connected with the terminal railroad of that company at its East Pittsburgh shops by an electric line.

ST. LOUIS, MO.—The Missouri Terminal Railway Company has applied to the city council for an ordinance granting it the right to maintain and operate a double-track passenger and freight railway in St. Louis, Mo.

SEATTLE, WASH.—The surveys for a line of street railway to the army post at Ft. Lawton have been nearly completed by the Seattle Electric Company. It is believed that the road will be built some time next spring.

COLORADO SPRINGS, COL.—Work is now being carried on upon the new line of the Colorado Springs & Suburban Railway Company to Cheyenne Cañon. The survey has been completed and the grading on parts of the line begun.

DETROIT, MICH.—Mr. F. A. Smart, who is the superintendent of the right of way for the Detroit Construction Company, has stated that the electric line from Detroit to Lansing will be built as soon as a private right of way has been secured.

CALDWELL, N. Y.—Messrs. Lockport and Soper have assigned the contract for carrying the mail between Caldwell and Warrensburgh to the Hudson Valley Railway Company. Messrs. Lockwood and Soper have the contract from the government.

CARTHAGE, N. Y.—The work of constructing the transmission line of the Carthage Electric Light and Power Company from Carthage to Belfort is being pushed along rapidly. The right of way for the entire distance has now been secured.

HANOVER, MASS.—A movement is now on foot to construct a street railway line from Rockland to Brant Rock via Marshfield. A meeting of those interested has been held. The new company is to be known as the Hanover & Brant Rock Street Railway Company.

BUFFALO, N. Y.—It is reported that the Buffalo, Niagara Falls & Rochester Electric Railway Company, which is known as the Ridge Road Trolley, has completed its necessary financial arrangements, and that the work of construction will be begun early in the spring.

SANDUSKY, OHIO—A general meeting of the Chamber of Commerce and citizens has been called to take action on the Huron Bridge matter. If a bridge were constructed across the Huron River it would permit the electric cars to run between Sandusky and Vermillion.

BUFFALO, N. Y.—The preliminary arrangements for the construction of a trolley line from Buffalo to Brocton by way of Silver Creek and Dunkirk are being made by Mr. Daniel F. Toomey. The material has been ordered and the work of construction will soon be begun.

RAUBSVILLE, PA.—A large addition to its power-house is being built by the Lehigh Power Company for the purpose of installing more dynamos. Water from the Delaware Canal is used in operating the present plant, but steam will be employed for the additional machinery.

CINCINNATI, OHIO—The work of constructing the line of the Cincinnati Rapid Railway Company between Cincinnati and Dayton has been begun, and the right of way has been secured for the entire distance. The line is to be completed and cars running by March 1, 1903.

PENDLETON, IND.—The survey for the Newcastle & Pendleton Railway has been completed between Newcastle and Pendleton. The survey of the line from Pendleton to Noblesville will shortly be begun. Nearly all the right of way between Newcastle and Pendleton has been secured.

WATERTOWN, CT.—A meeting has been held in the office of Lawyer J. T. Moran, in New Haven, for the purpose of considering the question of constructing a trolley line from Litchfield to Watertown. The object of the meeting was to receive and hear reports on the preliminary surveys.

ST. LOUIS, MO.—The franchises to make extensions and connections in various sections of the city have been granted to the East St. Louis Electric Street Railroad Company by the city council. It is planned to construct large extensions and in addition to erect another power-house.

DANVILLE, KY.—A company has been incorporated to construct an electric railway from Danville to Junction City and Shelby City. It is also proposed to light Danville and Junction City by electricity. The right of way for the whole distance has been secured, and it is expected that the road will be built within a short time.

WORCESTER, MASS.—The Worcester Traction Company, a company which was organized for the purpose of controlling the street railway system in Worcester, has been dissolved at a meeting of the stockholders. The company was capitalized at $460,000, which was subsequently reduced to $60,000.

FOSTORIA, OHIO—The capital stock of the Ohio Northwestern Railway Company which was organized a short time ago to build an electric line from Fostoria to Mungen has been increased to $500,000. It is said that the contract for building the railway is to be awarded to the Consolidated Railway and Light Company.

SPRINGFIELD, OHIO—General-Manager H. J. Crowley and Chief Engineer A. S. Kibbe, of the American Railway Company, which controls the plants of the Springfield Railway Company and the Springfield Light and Power Company, have been in the city inspecting the properties with regard to consolidating the two power plants.

PETERSBUEG, VA.—The work of laying the track of the Richmond & Petersburg Electric Railway has now been completed as far as Swift Creek, three miles from Richmond. The preparations to pass under the Belt line of the Atlantic Coast line are being made. It is expected that the road will be completed to Petersburg by January 1, 1902.

CHICAGO, ILL.—Ten suits were filed by the corporation counsel of Chicago against the Union Traction Company on December 3, the purpose of which was to secure judicial investigation of the transfer system now in force on the traction company's lines. It is claimed that on several lines transfers are refused in violation of the city ordinance.

FULTON, WIS.—The electric power-house for the purpose of furnishing light and power for Fulton and power for the interurban cars from Neenah to Kaukauna will furnish 5,000 horse-power, 3,000 of which is to be supplied by water-wheels and 2,000 by steam engines. It is expected that it will be completed by March 1, and that it will cost about $3,000,000.

CHICAGO, ILL.—Incorporation papers have been granted, by the authorities at Indianapolis, to the Chicago & Indiana Air Line Railway, capital $250,000, to build street car lines in South Bend, Michigan City and East Chicago to Chicago. The promoters of the plan and owners of the stock are W. O. Orton, G. W. Bryson and F. E. Griffin, all of Chicago.

READING, PA.—At a special meeting of the directors of the Kutztown & Reading Electric Railroad Company the bids for wiring, grading, etc., were opened and examined. The contract for the grading was not awarded, but it is said that it will be very shortly. Work will be begun at the Kutztown end of the line and pushed along as rapidly as possible.

LEXINGTON, KY.—The capital stock of the Georgetown & Lexington Traction Company has been increased from $5,000 to $250,000, and amended articles of incorporation filed in the County Clerk's office. This company is to maintain and operate a line of electric railway between Georgetown and Lexington. Messrs. William Adams and B. D. Berry, of Cynthiana, are among the stockholders.

KINGSTON, N. Y.—The State Board of Railroad Commissioners has given the Kingston Consolidated Railroad Company permission to issue a mortgage for $700,000, and also to increase its capital stock from $250,000 to $400,000. This company took over the Colonial Traction Company, of Kingston, and desires to employ the increased capital for purchasing the Kingston City road and also for new construction.

INDIANAPOLIS, IND.—The capital stock of the Indianapolis & Eastern Traction Company, which purchased a controlling interest in the Greenfield line a short time ago, has been increased from $200,000 to $800,000, of which $600,000 is common stock and $200,000 preferred stock. This increase of capital stock was for the purpose of beginning an extension of the line toward Richmond. Mr. Frank M. Fauvre is the president of the company.

ELECTRIC LIGHTING

NORTH BRANCH, MICH.—A new electric light plant has been completed and the town is now being lighted by electricity.

HELENA, OHIO—An electric light plant is being built by Z. C. Garn & Son, on Main street near the Pennsylvania Railway.

MT. VERNON, S. D.—The city authorities have purchased a street lighting plant which is to be installed within a short time.

ANDERSON, IND.—A new generator is soon to be installed by the electric light commissioners in the electric light plant.

BURLINGTON, IOWA—The new electric lighting contract with the People's Gas and Electric Company at Burlington has been signed.

SPRING LAKE, MICH.—The council of Spring Lake has made arrangements with the electric railway company to light the town with electric lights.

ALEXANDER, N. Y.—A new electric light plant for lighting their mill is to be installed by W. E. Moulton & Company, the machinery having now arrived.

MINOT, N. D.—Within a short time it is expected that the lighting plant and telephone system of the Minot Light and Telephone Company will be in operation.

MUNCIE, IND.—The building and lots where its plant is located have been purchased by the Muncie Electric Light Company from the Union Traction Company of Indiana.

BATH, ME.—Mr. Henry J. Kunzig has come from Philadelphia to install the electric lighting plant on the monitor Nevada. It is expected that the work will require several weeks.

SYRACUSE, N. Y.—A certificate for an increase of its capital stock from $2,500,000 to $4,000,000 has been filed by the Syracuse Lighting Company. This increase will be in common stock.

ONEIDA, N. Y.—The Warner electric light plant has been sold to the gas company, which now owns both electric light plants. The new company will take possession soon after January 1, 1902.

ALTOONA, PA.—The Edison Electric Illuminating Company, of Altoona, has finally passed under the control of the Electric Company of America. This company furnished electric light to Altoona.

LEESBURG, VA.—The right to erect poles in the streets has been granted to Mr. Beverly Chichester, who represents a new electric light company. It is proposed to add an ice plant and furnish power to other industries.

NEW ULM, MINN.—The engineer for the city electric light plant, Mr. Charles L. Pillsbury, of Minneapolis, has submitted plans calling for a complete revision of the entire plant, which was built about three years ago.

BOYNE CITY, MICH.—A contract has been made and a thirty-year franchise given to W. H. White & Company by the city council for street and commercial electric lighting. It is expected that the service will begin January 1, 1902.

CINCINNATI, OHIO—The plans for extensive additions to the electric generating plant of the Cincinnati Gas and Electric Company have been completed. A one-story building of the same type as the present structure is to be constructed near the present plant.

MOUNT VERNON, N. Y.—Mr. C. H. Scouten has sold the electric light plant to Messrs. W. H. and C. F. Franklin. Mr. Scouten purchased the property recently at a receiver's sale. It is said that the new owners intend to put in a system of waterworks in connection with the lighting plant.

NEWCASTLE, IND.—The stockholders of the Newcastle Gas and Electric Light Company have held a meeting for the purpose of discussing the present and future status of the plant. Committees for the purpose of investigating the different phases of the question were appointed. It is probable that work will soon be begun tending in the end to secure more light.

ALGIERS, LA.—The officials in charge of the New Orleans Naval Station have proposed to the Algiers Electric Company to extend its electric light service to the dock site. The reservation office is without illuminating facilities. When Captain Merrell, the commandant of the station, came to the dock site he issued orders for the purpose of inducing the company to extend its service to that place.

CINCINNATI, OHIO—A meeting of the stockholders of the Cincinnati Gas and Electric Company has been called for January 8 to vote upon the question of increasing the capital stock from $28,000,000 to $29,000,000. This company was organized last spring, and was the result of the consolidation of the Cincinnati Gas, Light and Coke Company and the Cincinnati Edison Electric Company, and several others which were absorbed at that time.

YORK HAVEN, PA.—The order for the turbine water-wheels and transmission machinery to be installed at the power station of the York Haven Water and Power Company has been given to the Robert Poole & Son Company, of Woodberry. This company is now building the penstocks and retaining walls for the plant. It is said that twenty electric generators of 1,000 horse-power each are to be installed. The current is to be generated at 2,400 volts and transformed to 24,000 volts for transmission to near-by cities.

NEW INCORPORATIONS

ELYRIA, OHIO—Citizens' Gas and Electric Company. $150,000.

UNION CITY, ILL.—Union City Telephone Company. $50,000. Mr. O. E. Green is secretary.

CHICAGO, ILL.—Chicago Moto-Cycle Company. Increased its capital stock from $2,500 to $4,800.

GREENCASTLE, ILL.—Greencastle Automobile Company. $25,000. Incorporators: C. H. Bell, G. E. Blake and others.

DULUTH, MINN.—Duluth General Electric Company. $100,000. Incorporators: A. W. Hartman, R. R. Dunn and others.

NEWTON, ILL.—Jaspar County Mutual Telephone Company. $5,000. Incorporators: William Kilgore, R. S. Hunt and others.

CHRISNEY, ILL.—Chrisney & Grandview Home Telephone Company. $5,000. Incorporators: L. F. Gage, George J. Clement and others.

LOUISVILLE, KY.—Louisville Home Telephone Company. $1,000,000. To construct, maintain and operate a telephone system in Louisville.

ONEONTA, N. Y.—The Ives Telephone Company. $25,000. To connect Oneonta with Cooperstown, Richfield Springs and Franklin, Delhi and Stamford.

GENESEO, ILL.—Geneseo Gas Company. $15,000. To operate heat, light and power plants. Incorporators: H. S. Pettigrew, Frank Kramer and others.

VERMILLION, OHIO—The Vermillion, Mansfield & Southern Railway Company. $10,000. To build an electric line from Vermillion through Erie, Huron, Ashland and Richard counties to Mansfield, with municipal systems in the terminal cities. Incorporators: E. L. Coen, George Fischer and others.

ELECTRICAL SECURITIES

The signs of prosperous business continue. Still the developments in the stock market during the week just closed would indicate that the speculative fever of the country has subsided. The great event of the week was, of course, the decline in Amalgamated Copper. This stock opened at about 75 and closed at 66. A few months ago it was selling at 130. It is reported to have been bought largely by investors, who have sustained by its decline very serious losses. There is still a hopeful feeling among the owners that the great general prosperity and demand for the copper output will yet furnish support to this stock. Its decline had a depressing effect on the entire market.

The clearing house banks showed a surplus on December 7 of $6,607,675, a decrease from the former Saturday of $6,806,900. A year ago at this date there was a surplus of $5,701,125, and two years ago a surplus of $6,859,525.

ELECTRICAL SECURITIES FOR WEEK ENDING DECEMBER 7.

New York:	Closing.
Brooklyn R. T.	63
Con. Gas	216
Gen. Elec	280⅛
Man. El	136
Met. St. Ry	160½
Kings Co. Elec	185
N. Y. & N. J. Tel. Co	166
Telep. Tel. & Cbl. Co	6½

The General Electric Company has declared a quarterly dividend of 2 per cent, payable January 15 to stockholders of December 31. There is no likelihood of the proposed stock restoration before next spring. The November earnings again reached $1,000,000.

Boston, December 7:	Closing.
Am. Telep. & Tel	160½
Erie Tel	15¼
New Eng. Tel	133
Mass. Elec. pf	94
Westing. Mfg. pf	81
Edison Elec	3¼

The Erie Telephone obligations of $9,000,000 will be paid on January 10, and important banking interests are expected to undertake the reorganization of the company. No plan, however, has been announced.

The Bell interests have acquired control of the Erie it is announced, paying from $15 to $20 per share to secure sufficient stock.

Philadelphia, December 7:	Closing.
Elec. Co. of America	6
Philadelphia Elec	4¼
Union Traction	32¾
United G. I. Co	117
Elec. Stor. Bat. c	64
Elec. Stor. Bat. pf	64

Chicago, December 7:	Closing.
Chicago Edison Light	157
Central Union Telephone	40
Chicago T lephone	230
National Carbon	20¾
National Carbon pf	82½
Un. Trac	10
Un. Trac. pf	47
Metropolitan El	90½

PERSONAL MENTION

DR. HOWARD BARNES has been appointed to an assistant professorship of physics at the University of Toronto.

MR. J. WHITE PENTECOST has been elected to the position of superintendent of the City Electric Light Plant in Nashville, Tenn.

PROFESSOR RICHARD A. HEINRICH, who is the general manager of the European Weston Electrical Instrument Company, Limited, of Berlin, Germany, is visiting the United States.

MR. HENRY HINE, of Colorado Springs, Col., who has been spending several weeks in the East, returned to his western home the first of this week after successfully completing a very important electrical deal.

SUPERINTENDENT SAMUEL HAIGH, of the Philadelphia & Delaware County Railway, is to retire. Mr. Arthur G. Jack, who is at present general manager of the Chester Traction Company, will take his place.

MR. REGINALD GORDON has resigned as instructor in physics at Columbia University to enter a mercantile business. Mr. H. C. Parker, at present tutor in physics, will take his place. Mr. G. B. Pegram will fill the tutorship left vacant by Mr. Parker.

MR. WILLIAM MARCONI has arrived at St. Johns, Newfoundland, accompanied by two assistants. As has already been stated in the ELECTRICAL REVIEW, Mr. Marconi will carry on a number of experiments in wireless telegraphy there, with a view to erecting a permanent station.

MR. W. W. BORMAN has returned to England. Mr. Borman has been the New York manager of the commercial electrical engineering and contracting firm of Robert W. Blackwell since the opening of the New York offices of that concern in the Beard Building at 120 Liberty street.

MR. GEORGE A. MCKINLOCK, president of the Central Electric Company, has been a visitor in New York and Lakewood for several days past. Mr. McKinlock was accompanied by his wife, who has completely recovered from very severe injuries received while horseback riding at Lake Forest, Ill.

MR. H. C. DODGE, formerly of Cleveland, Ohio, has opened offices at 1005 Monadnock Building, Chicago, as manager for the Williams-Abbott Electric Company, of Cleveland, well-known manufacturer of telephone apparatus. Mr. Dodge, who is very popular in the telephone field, is a welcomed addition to the electrical fraternity in Chicago.

MR. H. E. HUNTINGTON, who has made plans for extending the street railway line of the Los Angeles Railway Company, of Los Angeles, Cal., has left for New York to look after his interests there. A large part of the summer has been spent by Mr. Huntington in Los Angeles and he has made plans involving the expenditure of many millions of dollars for the next few years.

MR. E. P. EBBERTS, of Pittsburgh, secretary and treasurer of the Phœnix Glass Company, was a New York visitor last week. Mr. Ebberts has every reason to be greatly pleased with the business of his company during the year about to close, which is the most prosperous of the company's existence. The PHŒNIX GLASS COMPANY occupies an enviable position in its line of manufacture of electric and gas globes and shades, and the high-grade quality of its product is known in all parts of the world. The company does a large export business which is constantly increasing.

MR. CHARLES E. JOHNSON, who is the chief engineer of the McIntosh & Seymour Engine Company, of Auburn, N. Y., and who has just returned from the city of Mexico, speaks of the condition of the tramways in the city of Mexico as follows: A fine system is in operation there at present, but it is not yet completed and more work toward that end is to be done in the spring. The system is being built in sections and the mule cars which are in use in certain parts of the city are to be displaced as soon as the lines can be electrically equipped. Second-class cars are run as trailers. Upon these cars half fare is charged, which serves to separate the patrons.

MR. MARSDEN J. PERRY, of Providence, R. I., one of the most important figures in the industrial development of Rhode Island, and the controlling spirit of the electric lighting and street railway interests of Providence, is shortly to be married to Mrs. Marian L. Bogert, of that city. Mrs. Bogert is a daughter of Mr. Edward W. Lincoln, of Worcester, and a descendant of a colonial Massachusetts family of prominence. Mr. Perry, in addition to his activity in the electrical field, is one of the best known collectors of Americana in the country, and his residence contains probably the finest collection of colonial furniture and objects of artistic and historical interest connected with the American colonies in existence.

AUTOMOBILE NOTES

ELECTRIC LONG-DISTANCE AUTOMOBILE RECORDS BROKEN—All records for long-distance runs in electric automobiles have been broken by M. Kriéger, who is a well-known French manufacturer and chauffeur. Accompanied by M. Georges Prade, M. Kriéger made the journey from Paris to Chatellerault, a distance of about 190 miles, without recharging the batteries. An average speed of about twelve miles an hour was made.

AUTOMOBILES FOR POSTAL WAGONS—The experiments with automobile postal wagons, which the French Postal Administration began, are being continued in Paris. These wagons are used for collecting mail matter. A number of different forms of automobile mail wagons have been tried during the past year. A change from the ordinary wagons now in use represents a large outlay of money and the authorities desire to do a large amount of experimenting before taking any definite action.

EDUCATIONAL NEWS

MR. JOHN D. ROCKEFELLER, SR., has offered to give $230,000 for the erection on the campus of Bryn Mawr College of a new dormitory building and a central heating and electric lighting plant, provided the trustees succeed in raising $250,000 by commencement day, June, 1902.

AT CORNELL UNIVERSITY, Ithaca, N. Y., a very excellent course in mechanical engineering is offered by the Sibley College of Mechanical Engineering. The essential courses for a mechanical education are taught and a student who has successfully passed through this course of training should be well fitted for the work required by a mechanical engineer. Some courses in electrical work, of which an engineer should have a knowledge, are also given.

LEGAL NOTES

FRANCHISES TAXED SEPARATELY—The Supreme Court of Missouri handed down a decision on December 3 in the case of Gottleib against the Western Union Telegraph Company in which it is held that the telegraph company's franchises may be taxed separately from its tangible property.

RIGHTS OF A MUNICIPAL CORPORATION—A municipal corporation in whose streets a street railroad can not be operated without its consent is held in St. Louis & M. R. R. Co. *vs.* Kirkwood (Mo.) 53 L. R. A. 300, to have the right, in granting the consent, to limit the use of the railway to the carriage of passengers, and acceptance of the terms is held to be binding on the company, although it has charter power to carry freight also.

POWER OF A CITY COUNCIL—The power of a city council to compel a telephone or telegraph company to put its wires underground is upheld in Northwestern Telep. Exch. Co. *vs.* Minneapolis (Minn.) 53 L. R. A. 175, to the extent of exercising a reasonable discretion; but with the denial of any arbitrary power to make such a requirement unreasonable, where the overhead wires have been placed in the streets under authority of an ordinance constituting a contract.

TELEPHONE INDUSTRIAL NOTES.

THE ST. LOUIS ELECTRICAL SUPPLY COMPANY, whose new address is 1118 Pine street, St. Louis, Mo., carries in stock a large quantity of telephone supplies of all kinds, especially of line material and wire.

THE HAINES & NOYES COMPANY, of Chicago, manufactures a very interesting line of apartment-house telephones, adapted to be mounted in connection with hall letter-boxes or for intercommunicating purposes between tenants.

THE CHASE-SHAWMUT COMPANY, of Boston, Mass., is distributing a neat pamphlet in which the merits of the Boston cable clip are set forth. This clip is simple and strong, and is adjustable for the support of aerial cables.

THE SUN ELECTRIC MANUFACTURING COMPANY, of West Chester, Pa., has removed to its new factory, specially equipped for the manufacture of telephones, switchboards and accessories. A new catalogue will be sent on request to the above address.

THE MANHATTAN ELECTRIC SUPPLY COMPANY, New York and Chicago, is a large manufacturer of telephone apparatus. This company was one of the first in this field and has built up a very extensive business. Among its many other specialties is the Mesco battery which is particularly well adapted for telephone work.

THE D. A. KUSEL TELEPHONE AND ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is a maker of telephone supplies, and in its 1901 catalogue describes a number of them at length. These apparatus cover all the details of exchange and intercommunicating systems and supplies for such installations, as well as a variety of line material and appliances.

THE STERLING ELECTRIC COMPANY, of La Fayette, Ind., is running its factory twenty-four hours a day and employing 400 people. The factory is very complete and has recently been quadrupled in size and orders are still piling up. General Manager Doolittle states that the fine new telephone exchange his company is equipping for Toledo, Ohio, will be in running order in April next.

THE HIPWELL MANUFACTURING COMPANY, of Allegheny, Pa., manufactures long-distance telephone and telephone supplies of all kinds. Among these manufactures may be listed ringers and bridging generators, telephone sets, both of wall pattern and desk pattern, switchboards and parts of switchboards, intercommunicating telephones both for desk and wall use, receivers, transmitters, induction coils, and the other details which go to make up telephones. The company also manufactures expanding wire guards for incandescent lamps.

THE CHICAGO TELEPHONE SUPPLY COMPANY, Chicago, Ill., has recently published a booklet entitled "Crops, Comfort and Telephones," intended to give information to those dwelling in the country concerning the value and importance of telephone service for farmers and especially to show the importance of bridging telephones for such work. The booklet is a beautiful example of the printers and engravers' art, and contains matter of the highest interest to those who are in any way concerned with farmers' exchange or neighborhood cooperative telephone line business.

MESSRS. J. H. BUNNELL & COMPANY, 20 Park Place, New York, electrical manufacturers and dealers in electrical supplies, carry in hand constantly a very large stock of telephone appliances and apparatus of all kinds. Messrs. Bunnell & Company are among the oldest houses in this line of business in the United States and have supplied the apparatus for the installation of a very large number of telephone exchanges, intercommunicating systems and private lines. The telephone supply business is one that has engaged the particular attention of the house and on account of the large stock carried in hand it is ready at short notice to supply apparatus and appliances for practically any variety of telephone construction.

THE CLARK AUTOMATIC TELEPHONE SWITCHBOARD COMPANY, Providence, R. I., manufactures an automatic intercommunicating telephone system which is also useful for local exchange work. The instrument is operated by means of switches of the step-by-step automatic type, controlled by dials which are handled by the telephone users. The system has been installed in a large number of buildings such as offices, factories, etc., and in one or two towns, and has given very high satisfaction. The Clark switches are said to be less complicated than the majority of automatic telephone switches, the overall dimensions of the device being 4 inches square by 3¾ inches high for a system of seventy-five telephones. The company has recently brought out a catalogue very fully explaining and illustrating its manufactures.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, Cleveland, Ohio, has brought out its new catalogue No. 30 concerning switchboards. The catalogue contains a great deal of information of a practical and interesting character and several illustrations of switchboard apparatus of great interest. The company has lately organized, built and equipped a large number of exchanges through western New York and northern Pennsylvania, making for them the switchboards, telephones and other accessory apparatus. The central battery system is used, with all of the signals of the automatic electric lamp type. The relays in use both for the lines and for controlling and supervisory purposes are exceedingly simple. The open multiple method of wiring is used in the construction of the multiple switchboards, and it is claimed that it possesses great advantages.

THE SIMPLEX INTERIOR TELEPHONE COMPANY, Cincinnati, Ohio, manufactures telephone outfits for hotels, factories, workshops, and other situations requiring interior telephone systems. The new hotel telephone outfit is one of the most interesting of this company's specialties. This instrument occupies a wall space of only 4½ by 6½ inches, and is intended to replace the ordinary push-button in hotel bedrooms. The instruments are connected with an annunciator switchboard in the office, and it is claimed that their use enables a reduction of the bell-boy force of a hotel by at least one-third, thus making a considerable saving in the labor account. The company also makes a variety of other telephone apparatus, including intercommunicating instruments up to twenty circuits, and residence and short-line telephones, as well as emergency street railway telephone apparatus.

MR. HENRY SHAFER has resigned his position as general manager of the Stromberg-Carlson Telephone Manufacturing Company, and as secretary and treasurer of the Continental Construction Company, to accept the position of president of the International Telephone Manufacturing Company, Clinton and Harrison streets, Chicago. Mr. Shafer has been closely identified with the independent telephone business since its opening. He has been actively connected with the Stromberg-Carlson Telephone Manufacturing Company since its organization. Previous to that he was in the purchasing office of the Chicago Telephone Company for about five years. The International Telephone Manufacturing Company will have a full line of apparatus for large and small exchanges for generator-call and central-energy systems. Mr. Shafer retains his position as secretary and a director of the Municipal Signal Company, 204 Dearborn street, Chicago.

INDUSTRIAL ITEMS

ALFRED BOX & COMPANY, of Philadelphia, Pa., are completing orders for a number of electric traveling cranes intended for shipment to Japan.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, Ohio, has issued a number of attractive leaflets for the purpose of illustrating the different styles of its generators, which should be of interest to electrical men.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, Pa., is putting on the market a fine line of portable ammeters for direct-current circuits. These ammeters read both right and left from the zero, and are very convenient for uses to which such instruments are ordinarily put.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is calling attention to the fact that there are two good guarantees back of the goods it is selling, its own and the manufacturers of the various articles. This applies particularly to Gutmann integrating wattmeters, Packard incandescent lamps, Adams-Bagnall arc lamps, and Packard transformers.

THE AMERICAN SCHOOL OF CORRESPONDENCE, Boston, Mass., enables an ambitious young man to fit himself for a position as master mechanic, engineer or expert, in the various building trades. A special Christmas offer is made to all new students who enroll themselves in the full engineering course during December. A handbook of the schools will be sent to any one by writing to the schools.

THE OHIO ELECTRIC WORKS, of Cleveland, Ohio, is putting on the market Christmas tree lamps and battery complete. The lamps are in all colors. This company has issued a catalogue of Christmas presents for men and boys. It manufactures electric lights for neckties, bicycles, carriages and tables. The electric lights for Christmas trees which the company manufactures should be of great use in obviating the fires which frequently result from using candles.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., is sending out a small pamphlet illustrating some novel ideas in electric heating apparatus. A new electric heater is illustrated which is for use in houses, cold corners of offices, etc. It states that the current consumption of these heaters is small and that they can be operated at a nominal cost. These heaters are said to be rapidly superseding gas stoves, grate fires, etc., being much more economical and cleanly, and capable of easy regulation.

THE CENTRAL ELECTRIC COMPANY, of Chicago, has a large and complete stock of sleet proof pulleys, iron brackets, windlasses, street hoods, arc lamp cordage, etc. The season for installing this material is now at hand, and the company is prepared to make prompt shipments in order that customers may be supplied before the winter sets in. The same company has issued a neat folder for the purpose of illustrating and describing the various kinds and styles of incandescent lamps which it handles.

MR. JAMES G. BIDDLE, Stephen Girard Building, Philadelphia, has received orders for cable-testing equipments from such prominent companies as the Bell Telephone Company, of Philadelphia; Keystone Telephone Company, Philadelphia; Interstate Telephone Company, Trenton, N. J.; Reserve Construction Company, Cleveland, Ohio, and the Pittsburgh & Allegheny Telephone Company, Pittsburgh, Pa. All of these outfits included one or more of the Fisher cable testing sets, which have attained great favor in this class of work. The Fisher sets are made by Messrs. Leeds & Company, for whom Mr. Biddle is sole selling agent. By addressing him interested parties can secure a copy of catalogue 360 without charge; it describes the Fisher sets in detail, as well as accessory apparatus.

List of Electrical Patents Issued Last Week

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED DECEMBER 3, 1901.

687,723 Electric motor; D. P. Burdon, Jacksonville, Fla.

687,729 Oscillating device for brush-holders for electrical machines; Wm. Cooper, Cincinnati, Ohio—A shaft, a sleeve mounted thereon, means for rotating said sleeve, and a connection between said sleeve and said shaft whereby the rotation of said sleeve causes an oscillating motion of the same in the direction of the length of the shaft.

687,738 Lantern for electric or other lights; J. C. Fleming, Summit, N. J.

687,739 Reflector for lights; J. C. Fleming, Summit, N. J.

687,766 Trolley for electric railways employing overhead conductors; W. F. Mack, Bethlehem, Pa.

687,771 Time-check; E. A. Neubauer, Iron Mountain, Mich.

687,775 Electric latch for elevator doors; N. P. Otis, Yonkers, N. Y.—In a door fastening, a latch or bolt and a keeper and electrical terminals, controlled by a contact-piece carried by the bolt, and arranged to complete a circuit only when the bolt is in completed locking relation to the keeper.

687,800 Plant for the electrodeposition of metals; A. L. Walker, Perth Amboy, N. J.

687,813 Capping for electric conduits; W. F. Bossert, Utica, N. Y.—A capping for the ends of electric conduits, made from ductile sheet metal, consisting of a cylindrical attachment portion, and a protective portion in the form of a ring or nosing constituting the entrance to the capping.

687,816 Signal operating apparatus; C. W. Coleman, Westfield, N. J.—A motor, devices for operating a signal or object to be moved into set position, connections between the motor and such devices including a stationary magnet, a clutch, and an actuating device therefor controlled by the magnet, the clutch and actuating device being yieldingly connected together and so arranged that, when the actuating device is held in its actuating position, the clutch will operatively connect the motor with the devices for operating the signal or other object to move the signal or other object into set position without moving the magnet and, when the actuating device is in its inoperative condition, the clutch will be inoperative and the signal or other object will be discontinued from the motor.

687,829 Electric controller; C. H. Keeney, Milwaukee, Wis.—A single solenoid and its reciprocable core, means actuated by the movement of the solenoid-core in one direction for successively cutting out resistance, and mechanical means for putting in the resistance.

687,833 Battery; P. E. Francken, Brussels, Belgium.

(Continued on page 68.)

ELECTRIC CONDENSERS
WM. MARSHALL, Manufacturer
Standards a Specialty
709 Lexington Ave., New York

$5 VOLT AMMETER FOR STUDENTS' USE.
(Jewell Bearing and Aluminum Case.) Adapted to primary and storage battery work. List of schools using it mailed on application. The method of its use described in a circular just issued.
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PATENTS.
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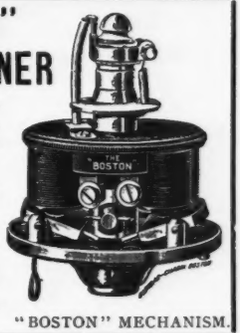

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PATENTS.

(*Continued from page 67.*)

687,865 Programme clock; A. W. South, Iatan, Mo.

687,881 Apparatus and circuit for operating electric lamps; P. C. Hewitt, New York, N. Y.

687,882 Vapor lamp; P. C. Hewitt, New York, N. Y.—An electric lamp, comprising a vapor or gas chamber and a vapor or gas within the same constituting a conducting path which is of considerable length as compared with its diameter of electrodes at the respective ends of the chamber, and a return tube connecting different portions of the chamber.

687,883 Terminal for electric vapor or gas lamps; F. C. Hewitt, New York, N. Y.

687,885 Electric battery; George d'Infreville, New York, N. Y.

687,895 Vacuum-breaking device; T. D. Millea, Springfield, Mass

687,903 Electrical heat-regulating apparatus; H. Schultz, Berlin, Germany.

687,916 Electric switch; E. S. Cook, London, England.

687,931 Magnetic holding-table for metal-working machines; Mark Barr, Broadheath, England.

687,932 Electric conductor and attachment for printing-presses; C. H. Colby, Mount Pleasant, Iowa—A device for collecting and conveying electricity from paper on the feed-board of a printing-press, a rigid skeleton metal frame of triangular shape having conducting brushes on its under side and means for suspending the frame in a plane above the feed-board, to operate in the manner set forth.

687,943 Electric lamp; T. A. Smith, Azusa, Cal.

687,948 Electric signaling and indicating apparatus; F. W. Wood, Newport News, Va.

687,982 Implement for sinking electrical ground plugs; W. E. Fisher, Bloomsburg, Pa.

687,991 Dynamo frame; A. Churchward, Chicago, Ill.

687,992 Dynamo-electric machinery; A. Churchward, Chicago, Ill.

(*Concluded on page 70.*)

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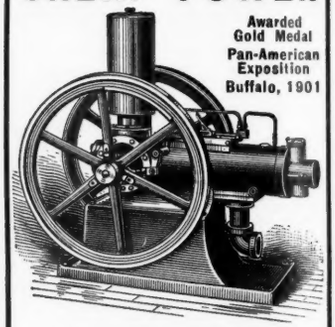
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